VOL. LXXXVII. No. 2235. [All Rights Reserved.] SEPTEMBER 24, 1920. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of Postage.] PRICE SIXPENCE.

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C. 4. SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.: Canada, £1 12s. 6d.; Colonial and Foreign, £2 1s. 6d. per annum.—NEW YORK: D. VAN NOSTRAND Co., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie, Etrangère, 22, Rue de la Banque.
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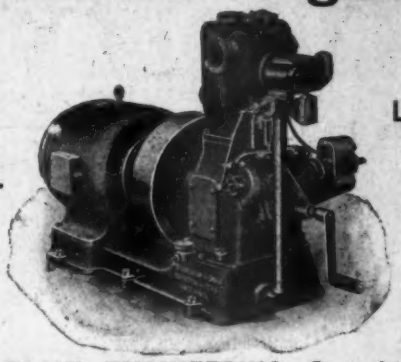

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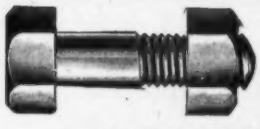

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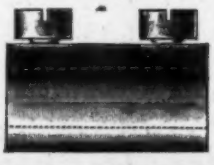

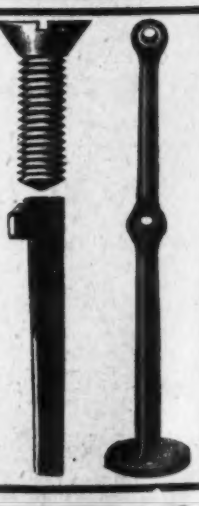

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VOL. LXXXVII. SEPTEMBER 24, 1920. No. 2,235.

ELECTRICAL REVIEW.

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THE ENGINEERING DISPUTE.

ON Friday last the dispute between the Electrical Trades Union and the Engineering and National Employers' Federations came to an end; the parties respectively withdrew their strike and lock-out notices, and in due course work was resumed. The method by which this happy result was attained is interesting.

As our readers are aware, the Court of Inquiry appointed by the Minister of Labour to inquire into the Electrical Trades Dispute at Penistone was opened on September 14th, and commenced its operations in private. It had no concern with the strike of employés in the London electric power stations and sub-stations, of which notice had been given by the E.T.U. to expire on Saturday last.

However, at the request of the Minister, a special meeting of the National Joint Industrial Council for the Electricity Supply Industry was held on September 15th, to consider the position arising from the strike notices issued by the E.T.U. in London and certain other districts, and after discussion, the E.T.U. having decided to withdraw the question of principle arising out of the Penistone dispute, the Council recommended that the lock-out and strike notices should be withdrawn and work resumed. Both sides then asked the Court on the 16th inst. to adjourn the proceedings, and on Friday an agreement was read before the Court, which, having no occasion for further action, was adjourned *sine die*. Thus peace was restored and the threat to London removed, a consummation for which we may all be truly thankful. We trust that the truce will be maintained also *sine die*.

While we are not in sympathy with the claim of the Electrical Trades Union, we do not question its right to strike in support of that claim; neither do we deny the right of the employers to lock out, in self defence—though we strongly demur to the adoption of such fighting tactics on either side, if peaceful methods of arriving at a satisfactory settlement are available. The dispute was a private one, in which the public was only indirectly concerned. It is curious that this dispute should have been settled by the good offices of the National Council, which was invited to inquire into a consequential strike, but not into the Penistone dispute, while the Court of Inquiry set up for the latter purpose was short-circuited. It is a feather in the cap of the Whitley Council, to which we offer our congratulations; having ardently supported the Whitley scheme from its initiation, we rejoice in this further success which it has achieved.

With regard to the London strike, which was, so to speak, a side-show, but bade fair to become the main theme of the drama, in tragic form, totally different questions arose. The Electrical Trades Union, in the hope of forcing the public to take a hand in its private quarrel, threatened to deprive it of a great and indispensable public service; the

Union had no quarrel with the power station authorities, from whom it proposed to withdraw its members—the blow was unquestionably and deliberately aimed at the people of London, an inoffensive third party. And this threat involved another Trade Union in the tangle—the Electrical Power Engineers' Association—which issued a manifesto bearing on the situation. The E.P.E.A. declared that it would "throw its weight" into the scale against whichever party refused to submit the dispute to arbitration, *i.e.*, the employers, and in our last issue we commented on its action in terms to which the Association takes exception—though some of its members, as will be gathered from the letters in our last and current issues, are plainly at one with us. We have been at pains to ascertain precisely what is the point of view of the Executive Council, and we find, on the authority of the general secretary, Mr. W. Arthur Jones, that it is as follows :—

The essential principle of the Association, in the case of all questions in dispute, is that before a strike or lock-out is declared, all possible means of settlement by existing machinery should be utilised, no matter whether the interests of the Association or other interests are at stake.

In the event of another Trade Union giving notice of a strike in power stations and sub-stations, a neutral attitude on the part of the Association is impracticable. The E.P.E.A., however, cannot impose on itself the duty of deciding on the merits of a dispute between another Trade Union and the employers of both parties. Neutrality being impracticable, its action will be dictated by the consideration outlined above.

The E.P.E.A. holds that any Trade Union is justified in utilising its whole strength in support of a section engaged in a dispute, even though that involves other industries previously at peace, including public electricity supply.

That, then, is the policy of the Electrical Power Engineers' Association. It denies that there is any agreement with other Unions, but it has marked out its line of action. So far as that is intended to encourage the attainment of "peace by negotiation" we are entirely in accord with it ; but when it is laid down that the merits of a dispute shall not be considered, the policy becomes untenable, and involves the surrender of all claim to the possession of intelligence on the part of the Association, which then becomes no better than a machine.

If the matter in dispute related to wages or working conditions—questions of fact—we could accept the position of the Association, for such questions undoubtedly ought to be the subject of friendly arrangement ; but when questions of principle are involved, the case assumes a wholly different aspect—such questions cannot be submitted to arbitration, and the E.P.E.A. formula is inapplicable.

In the case before us, two great questions of principle arose : first, whether employers were entitled to manage their works ; secondly, whether it was right that the public interests should be held to ransom for the sake of a private dispute. Neither of these questions was suitable for arbitration ; neither of them was incapable of solution by the exercise of the mental faculties ; and both of them should have been fully considered on their merits by the Executive Committee before a decision was formed. To claim to be the ardent upholders of constitutional methods and then to discard the exercise of intellect in favour of a mechanical process which had no actual bearing on the case, argues mental incapacity. For, observe, when the E.T.U. declared for a strike in electricity works, a new situation at once arose : that part of the struggle in which the E.P.E.A. was likely to be involved, was to be fought between the E.T.U. on the one hand, and the supply authorities and the general public on the other, the latter being wholly disinterested parties. Were they asked whether they would go to arbitration ? *Could* they have gone to arbitration when there was no question at issue between them ? The matter reduces itself to an absurdity.

The E.P.E.A. Executive, whilst waving the banner of peaceful negotiation and constitutional methods, deliberately endorsed the action of the E.T.U. in declaring war on neutral parties—the supply authorities and the public—and by so doing nearly precipitated a calamity ; for the E.T.U. would not have thus invaded neutral territory if it had not been able to count on the support of the E.P.E.A. Executive, *promised in advance*. As a matter of fact, it was the discovery that the support upon which it counted would not be given that led to the collapse of the campaign.

Power-station Neglect at Petrograd.

According to a German newspaper, the managers of the Petrograd Electric Lighting Co. of 1886 recently presented a report to the local National Economic Council showing that the company's works have been almost destroyed by neglect, and other works in that city are assumed to be in the same situation. The report states that the deterioration in the technical equipment extends to an important part of the machinery and plant. Thus only one-half of the boilers fitted for coal-firing are able to be worked at a pinch ; only four of the six boilers equipped for wood-firing are able to be worked, and five of the six oil-fired boilers are still serviceable. The managers emphasise the necessity for the fundamental renewal of the entire boiler plant, particularly the mechanical coal transport plant, owing to the great corrosion which has taken place. In addition, the boiler-house buildings require renewal as well as the turbine department, and it is considered that the whole works will be brought to a standstill unless remedies are speedily applied.

The Long-suffering Lampholder.

The increasing tendency to divert the lampholder from its legitimate use to the functions of a universal multiple-way wall socket, and the unhappy consequences which often follow that abuse, are doubtless well known to most of our readers ; it is high time that steps were taken to check the practice, which is bound to bring serious discredit upon the electrical industry. The bayonet holder, although it is far inferior to the screw socket, is nevertheless capable of giving satisfaction for long periods when it is called upon to carry only the fraction of an ampere, which is its normal duty ; but when a one-kilowatt radiator, or an adapter feeding several devices simultaneously, is coupled to it, overheating and breakdown are inevitable. The non-technical user, who only too often has been taught this objectionable practice by an electrician who ought to know better, blames the system, innocently unconscious of his own share in the mishap.

Apparently the same conditions obtain in the United States, for we learn from the Society for Electrical Development that steps are being taken to put an end to them, by drawing the attention of manufacturers to the matter and inviting them to assist in educating the public, and to avoid showing appliances connected to lampholders which are not suitable for such use. Instances are cited of such combinations as an electric range and a vacuum cleaner, or a washing machine and a domestic electric motor, an iron and an electric radiator, being illustrated in advertisements as connected to a two-way adapter in a lampholder. Even the screw holder, which is better adapted to withstand overloading than the spring-contact bayonet type, cannot be expected to stand up against such gross misuse—to say nothing of the wiring. Such illustrations should not be used, and the practice of misapplying lampholders ought to be discouraged by electricians and contractors.

THE MUNICIPAL TRAMWAYS ASSOCIATION

(INCORPORATED).—II.

In our last issue we briefly outlined the proceedings at the Conference of the Municipal Tramways Association, so far as circumstances permitted. We are now able to give a more detailed account of them than could be embodied in telegrams received on "press day." But first we would pay a tribute of admiration to the magnificent range of public buildings, situated in a picturesque park almost in the heart of the city, for which the people of Cardiff are indebted to the foresight of the Corporation towards the end of last century. It was in the council room of the City Hall, the principal building, that the Lord Mayor (Councillor G. F. Forsdike, J.P.) welcomed the Association, and eulogised the value of its work. Referring to the difficult problems that had now to be faced in civic affairs, compared with the situation in 1914, he expressed a most optimistic view with regard to the prospects of improved relations between employers and employed, and cited as a case in point the settlement of the recent strike of municipal employés in Cardiff, which was effected when the leaders of the movement were made fully acquainted with the conditions that obtained. The horror of the war still overshadowed us; as we got further away from that, the present industrial clouds would pass away.

The President, Ald. Sir John W. Courtis, after thanking the Lord Mayor, read his address, of which an abstract follows. The Vice-President, Mr. G. W. Holford, of Salford, moved a vote of thanks, which was seconded by Mr. Squires, chairman of the L.C.C. Highways Committee, and duly accorded. The papers on "Tramway Fares" by Coun. Higham (Blackburn) and Mr. P. Priestly (Liverpool), of which we gave abstracts in our last issue, were then read, and the animated discussion which followed was prolonged into the afternoon session.

At the luncheon given by the chairman (Sir John Courtis) and members of the Tramway Committee, amongst the guests were Mr. C. G. Tegetmeier, chairman of the Tramways and Light Railways Association, Mr. John Young, formerly of Glasgow, Mr. C. J. Spencer, manager of the Metropolitan Electric, &c., Tramways, and former hon. secretary of the Association, and Mr. A. M. Todd, president of the Public Ownership League of America. The Lord Mayor, proposing "The Municipal Tramways Association," referred to the thankless task of those engaged in public work, and claimed that British local authorities were carrying on their voluntary labours extremely well under exceedingly trying conditions; the Government showed them no favour, and they had to fight to get reasonably fair treatment. Sir John Courtis responded, and the Sheriff of Belfast proposed the health of the chairman and members of the Cardiff Tramways Committee, to which Ald. Morgan Thomas responded.

After the conclusion of the discussion on "Tramway Fares," Mr. A. L. C. Fell (London County Council) read a paper on "Power Expenses," and the discussion occupied the rest of the afternoon. A telegram of good wishes was sent from the Conference to Mr. A. Baker (Birmingham), who was prevented by illness from attending, and a reply was read on the following day.

A demonstration of the Quasi-arc system of electric welding was given in the evening, and at 8 o'clock a reception was held by the Lord Mayor and Lady Mayoress at the City Hall, supported by Sir John and Lady Courtis and Mr. A. M. Todd. A delightful musical entertainment was given by a large choir of female voices, and light refreshments were provided; the function was extremely enjoyable.

On Thursday morning, after the managers' meeting had been held, the Conference resumed; Mr. Dalrymple (Glasgow) was unable to attend, owing to the decision of the tramwaymen to strike, so his paper on "Tramway Finance" was read by the secretary, Mr. J. Beckett. Mr. Horsfield (Cardiff) read a paper on the same subject, and the two were discussed together. Afterwards a paper on "Capital Expenditure" was read by Mr. R. Stuart Pilcher (Edinburgh), and discussed.

At the annual luncheon of the Association, which was held at the Royal Hotel, Sir John W. Courtis presiding, Mr. G. W. Holford (vice-president) proposed "The Cardiff Corporation Tramways Committee," and Ald. R. J. Smith responded. The toast of "Our Visitors" was proposed by Ald. Mayne (Sheriff of Newcastle-upon-Tyne), who referred to the great benefits that had been derived from the cordial co-operation of the two Tramway Associations. Mr. A. M. Todd responded, eulogising the high standards of civic government in this country and the absence of "graft."

In the afternoon a photograph of the Conference was taken, in spite of an unpleasant break in the weather, on the steps of the Law Courts, and afterwards the annual meeting was held. The report of the Executive Council and the statement of accounts were adopted, and the election of officers and members of committee was carried out, with the following result: President, Mr. G. W. Holford (Salford); vice-president, Ald. R. Mayne, J.P. (Newcastle-upon-Tyne); hon. treasurer, Mr. A. R. Fearnley (Sheffield); hon. solicitors, Mr. Heath and Mr. S. F. James; Managers, Messrs. J. M. McElroy (Manchester), A. Baker (Birmingham), and H. Mozley (Burnley); Councillors, Coun. C. Higham (Blackburn) and Coun. Sellers. Mr. Peter Fisher (Dundee) having resigned owing to a change in occupation, was elected an honorary member. Votes of thanks to the chairman, the Executive Council, the representatives of the Association on the National Industrial Council, and the municipality and officials of Cardiff, were cordially awarded. Mr. Beckett announced that the Association had at last been able to secure offices in London. The Conference was then adjourned. On Friday an excursion to Weston-super-Mare and Cheddar, for which the charabancs were provided free of charge by the Bristol Tramways & Carriage Co., Ltd., was the sole item on the programme.

To sum up, the Conference at Cardiff was an unqualified success, taking high rank in the history of the Association. The Lord Mayor (Coun. G. F. Forsdike) won the hearts of all the members and the ladies, of whom a large number were present, by the distinguished courtesy and charm with which he filled his high office, his solicitude for the comfort and happiness of the visitors—even to the extent of making special arrangements with the clerk of the weather (to which, unfortunately, the latter did not strictly adhere)—and the tact and appropriateness of his many, but brief, speeches; we do not hesitate to say that his share in the proceedings could not have been performed more gracefully or more efficiently. The president, Sir John W. Courtis, conducted the proceedings with dignity and ability which left no loophole for criticism, and the secretary, Mr. Beckett, was ubiquitous, untiring, and never at a loss for either words or actions.

One feature of the speeches of the municipal representatives, on which they all laid emphasis, was the fact that Cardiff, though a great coaling centre, was not, as many thought, a "coaly" town; their disclaimer was justified, and they are entitled to be proud of their youthful city (it has not attained its majority yet).

Presidential Address.

By Sir John W. Courtis, J.P. (Chairman of Tramways Committee, Cardiff).

(*Abstract.*)

Let me remind you that your visit here synchronises with the 50th anniversary of the establishment by Parliament of tramways in this country. Within the past half-century, £79,000,000 has been expended on tramway construction and development. Of that sum £54,000,000 has been incurred by local authorities. Since 1878 the length of route open for public traffic in the United Kingdom has increased from 269 miles to 2,728 miles in 1918-19. Of the last-named distance 1,713 miles were owned and worked by local authorities, and 146 miles owned by local authorities were worked by companies. The mileage worked by electric traction was 2,660, or 97.5 per cent. of the total.

Compared with the last completed year prior to the war (1913-14) the total number of passengers carried has risen from 3,426,473,192 to 4,557,640,078 in 1918-19, an increase of 33 per cent. In the same period the number of car-miles run has decreased from 354,379,672 to 320,378,376, with the result that the average number of passengers per car-mile is now 14.2, as compared with 9.7 in 1913-14. The number of journeys per head of the population works out at 108, as compared with 74 in 1913-14; whilst the number of passengers carried per mile of route open was 1,668,122, an increase of 31.6 per cent. on the pre-war figure.

The number of local authorities which have obtained powers in connection with railless trolley undertakings is 26, and of these only seven actually carried passengers. Five companies have also obtained powers, of which only one was operated during 1918.

Whatever form of road transport may exist, or may emerge from future experiments, the first and paramount condition must be that in this purely commercial sphere, the passenger must pay for his passage. The man who does not travel should not, in equity, pay any part of the fare of the man who does. That is manifestly the only sound policy to apply to a public service which is made use of optionally by the community.

Increases in fares on tramways have become as much a necessity as the increase in the price of any other commodity, but it has been reserved for tramways, almost alone among public utility services, to encounter an unreasoning opposition to the common custom and economic necessity of handing on the increased cost to the consumer. My submission is that it is not our business, as the administrators of a great industry, to sell a ride to anyone, either resident or non-resident, at less than cost price. The accounts of almost all our undertakings for 1919-20 have brought home to the community the sharp reminder that we have been doing so during the past year.

It is the opposition to which I have referred that has been the greatest stumbling block in the path of the National Council in dealing with the wages question, which has absorbed most of the time of that body since it was constituted in September, 1919.

Limited by statute in our charging capacity, and opposed by public sentiment to increased fares, the finances of the industry have drifted into a state of difficulty, and of some danger to our stability. Our first and foremost duty to-day is to endeavour to awaken the public mind to the absolute necessity for increased revenue. By all means let the employés have adequate wages for their services, but by all means likewise let the users of tramways recognise the resultant demands upon them.

Part of the time of last year's Conference in Dundee was occupied in considering the arrangements for dealing with the application made in July, 1919, for a further increase in wages. Immediately after that Conference, the Interim Court of Arbitration conducted an inquiry. Up to and including the award following the inquiry, the war bonuses granted nationally amounted to £1 14s. per week. The further application made during the year has been dealt with by the National Council.

The National Industrial Councils, with their constituent District Councils, are a new and distinctive instrument in the commercial life of the nation. They mark a new departure in our endeavours to secure a continuity of industrial peace. They occupy a position of the first importance in our attempts to find a solution for the most pressing problem of our time.

The outstanding achievement of the National Council is the passing of the Tramways (Temporary Increase in Charges) Act, 1920, arising out of an investigation of the tramway budgets for the current year. It is for us to use that Act to the extent of making tramways generally self-supporting. The National Council has also rendered service, through the Standing Committee, in a number of questions which affect us all in common.

The burden of road maintenance, constantly added to by reason of heavy commercial vehicle transport, is ripe for adjustment. The appropriation of the proceeds from the taxation of mechanically-propelled vehicles has occupied the attention of the Executive Council during the year. The claim of the tramway authorities to share in the yield of such taxation is irresistible in these days of electric traction. It is our bounden duty to press that claim.

Again, the question of rate-aid from tramways must be considered. No sanction to increase fares under the Act of 1920 will be granted for the purpose of producing profits to be applied in reduction of direct local taxation. The obvious corollary is that under normal conditions, no money must be taken from the rates to subsidise tramways. Self-support should be the watchword.

After very exhaustive investigations and experiments the Special Committee on the standardisation of over-head line material has been able to present a most valuable report, together with specifications and drawings. The existing diversity in overhead equipment is shown to be both cumbrous and expensive. The need for such diversity no longer exists. Nothing need be scrapped before the end of its useful life.

The suggestion of the committee has been adopted by the Executive Council, that a Standing Committee should be appointed to which all questions of further improvements may be referred from time to time. The existing members have been asked to constitute that committee and to report upon the progress made in adopting the new standards.

I should like to pay my tribute to the excellent manner in which Mr. Beckett has discharged his duties during his first year of office.

Tramway Fares.

The papers by Coun. Higham and Mr. Priestly on this subject were discussed together.

Ald. Smith (Liverpool) expressed the view that a due proportion of the receipts should be allocated to the rates.

Mr. W. Murray (Walthamstow) said that the difficulties of small undertakings were greater than those of the large ones; the routes being short, if the fares were too high the people would walk. They could not abolish the penny fare. He held that a uniform rate per mile should be charged, and that the long-distance rates should be raised to comply with that policy. Some Councils decided to charge low fares and make up the deficiency out of the rates; that policy was not satisfactory to the manager, who was often blamed for making a loss. An alternative policy was to provide free transport.

Coun. Naylor (Liverpool) repudiated Ald. Smith's policy, and said that in Liverpool the tramways were instituted for the public convenience, but were turned into a "milch cow," and as a result had become practically bankrupt. It was absolutely necessary to raise the fares, and no favour should be shown to any class of passenger. The maintenance of the system should be the first consideration.

Coun. Fisher (Perth) asked whether authority could be obtained to charge special fares for special services (such as race meetings), and Mr. Holford stated that Salford had secured such powers in a recent Act.

Mr. E. S. Rayner (Hull) supported the authors' views, and pointed out that the fixing of fares was a technical question, depending upon the choice of a proper frequency of service, size of car, &c. If they were going to allow unlimited overcrowding and lower the standard of service they might make ends meet, but if they were to maintain the former high standards, increased fares were necessary. They must educate the public to realise the depreciated value of the penny; as the penny postage had been raised to 2d., so the penny fare should be doubled. It was better policy to retain the old stages and raise the fares than to change the stages; and to increase the frequency of traffic, besides increasing the fares. The introduction of a 1½d. coin would immensely facilitate matters; the use of two coins instead of one had an adverse psychological effect.

Mr. J. S. D. Moffet (Belfast) described the course of events in Belfast, where he had introduced a graded overlapping-stage system with good results; the limit of one mile for 1d. had been reached—the next step would be to charge 1½d.

Ald. Stanbury (Oldham) said that there they had substituted 1½d. for the penny fare, and so on in proportion, with the result that they made a profit, and had maintained the plant efficiently.

Mr. J. B. Hamilton (Leeds) said the authors' views were sound, but how was an adequate fare to be settled? They should endeavour to determine correctly what each fare ought to be, and if they charged an adequate fare, the public would pay it when convinced that it was necessary. The great difficulty had been the continual increase in the costs, rendering forecasts unreliable. An exhaustive analysis should be made of the working conditions, hours of travel, &c. The change of workmen's hours had created an immense development of traffic between 5 and 6.30 p.m., with which it was impossible to cope.

Coun. Squires (Chairman, L.C.C. Highways Committee) agreed with the authors, and condemned contributions to the rates. The extra working costs due to an award of 9s. per week per man amounted in London to £270,000 a year; these facts had to be explained to the public. He had always opposed the cheap midday fare, and was in favour of the adjustment of fares to meet the costs—the public would not object to that.

Coun. Turner (Belfast) supported the authors, and said that the charges should be fixed to meet the expenses.

After an adjournment for luncheon, Mr. H. Mozley (Burnley) emphasised the importance of seeing that all the fares

were collected, and advocated the collection of tickets by the conductors as an effectual remedy. He estimated that the loss due to missed fares in this country amounted to half a million sterling per annum. At Burnley the practice had been carried on successfully for 40 years. With regard to workmen's fares, he differed entirely from the authors; he held that the workmen's-fare traffic was the most economical, the cars running full and earning four times as much as ordinary cars. To abolish workmen's fares was contrary to public policy.

Ald. New (Sunderland) had heard no reason why workmen should receive preferential treatment. The collection of tickets would impose an additional burden on conductors without stopping dishonesty.

Mr. H. P. Stokes (Plymouth) said the question had been changed by the increased spending power of the worker, the chief customer of the tramways, and the increased expenses had been partially met by increased traffic. At Plymouth there were no differential fares; the minimum was 1½d., and they had retained all their traffic. The stages varied from ¾ to 1¾ miles for 1½d., the average being 2.72 miles. He agreed in the main with the authors; but Mr. Priestly said they should accumulate funds not only for maintenance but also for improvements and extensions—would any municipality contemplate providing for extensions out of revenue? That was a kind of profit-making.

Mr. J. M. McElroy (Manchester) agreed with Mr. Hamilton that they ought to find out the exact cost in each undertaking, inclusive of all items; then ascertain the revenue required to meet the cost, explain the facts to the public, and the latter would be willing to pay the price. Whether they should charge a higher fare for the first mile than the average fare was a question of policy for the committee to settle, but the manager ought to be able to tell the committee how to cover the expenses when the policy had been fixed.

Mr. J. Barnard (Bolton) agreed with Mr. McElroy, and said that Bolton was the only town that had not changed the pre-war fares or shortened stages, but it still provided for depreciation and contributed to the rates. The receipts were still increasing; they carried 32 millions yearly before the war, and 52 millions now, with the same rolling stock. With regard to Mr. Mozley's system, there were many tricks on tramcars, and he offered to teach him some of them!

In reply, Coun. Higham said the relief of rates was a pernicious system, which tended to grow worse, and robbed the reserve fund. With regard to small undertakings, the only logical course was to recognise the depreciation of the penny, which was no longer an economic fare. The abolition of workmen's fares had been generally agreed to.

Mr. Priestly, replying, said the policy of providing for extensions was on the safe side. He was not convinced that workmen's fares were ever remunerative. If the tickets collected on the Burnley cars were not checked against the waybills, the system was worthless.

THE JACKSON ELECTRIC STOVE CO., LTD.

NEW SHOWROOMS.

On Friday last we had the pleasure of visiting the new showrooms which have been opened at 143, Sloane Street, S.W. 1, by the Jackson Electric Stove Co., Ltd., and inspecting the apparatus therein displayed, representing the latest designs and improvements that have been introduced by the company.

It is interesting to note that, although the firm has been in existence for some 10 years, and has manufactured many thousands of cooking stoves and appliances, thereby gaining a reputation second to none in this branch of British industry, the directors consider that their real work is only now beginning! Exactly what this means will be appreciated if we give a short sketch of the company's history.

The first step was taken when Mr. F. H. Williams, formerly of the Phœnix Electric Heating Co., joined Messrs. T. and J. Jackson, and started a small heating and cooking department. No effort was made to secure orders, but they began to flow in at an embarrassing rate, and by 1912 it was found necessary to establish works devoted to this section of the business. The manufacture was naturally in great measure experimental, as experience had to be gained under working conditions before the business could be developed on a large scale, and in 1913 it was decided to form a separate company for the heating and cooking business, under the style at the head of this article; the intention was to extend the works and acquire experience for a year or two before opening a selling campaign, and this policy was followed, although competition was springing up all round. The business, however, continued to increase, and in 1914 it was thought that the time had arrived for a further step—when the war broke out, and instantly the situation was entirely changed. A large demand for cooking apparatus for Government departments, particularly the Admiralty, at once developed and was maintained till the end of the war; a very large percentage of the cooking apparatus installed by the Admiralty on submarines and other small craft was made by "Jacksons," though none of it was of standard type. The Ministry of Munitions also required canteen equipments for factories, including ovens capable of baking 300 lb. of meat at once, with other large apparatus, and the Royal Flying Corps and the War Office demanded hospital equipments, sterilisers, &c., while at a later period the Minister of Food made great calls on the company for the equipment of the National Kitchens. Nevertheless, until the rationing of raw materials began, large installations, such as those at Messrs. Swan & Edgar's, Selfridge's, and Carrick's (of Newcastle-on-Tyne), were supplied to civilian orders. Naturally, during this strenuous period, experimental work was impossible, but valuable experience was gained—so much, in fact, that when the war ended, the company found itself in possession of a vast amount of knowledge, and in a position to go ahead "all out." Hence the new showrooms and the campaign which is now opening.

The principal showroom, which is illustrated in fig. 1, is on the ground floor, and is handsomely panelled with dark oak; it contains selections from the company's apparatus

Fig. 1.—Messrs. Jackson's New Showroom.

Fig. 2.—Electric Kitchen at Messrs. Jackson's.

ranging from a small toaster to a big double-oven. Behind this room is a large demonstration kitchen, fig. 2, with a tiled floor, and equipped with cookers of various sizes, wash-boilers, water-heaters, &c. Taking items at random, we may mention a tea-urn with a glass-enamelled removable metal interior, free from the fragility of the customary type; an electric cooker, of which many hundreds have been sold in a few months, having a fixed boiling pan loaded to 600 watts with regulation to 300 and 150 watts, which can be switched on dry without injury, and is provided with a detachable tap and a pair of steamers, while the hob-table is hinged, and can be turned right back, exposing the whole of the "works"; a bath-water-heater, with a 6-winged 6-kw. immersion heater, removable at pleasure, and capable of heating 16 or 17 gallons of water every half-hour (this heater cannot be run dry, for the hot water is pushed out from the top by cold water let in at the bottom); a wash-boiler, of cast-iron and welded steel, which cannot be burnt out; a large boiling urn, with a flat smooth bottom, also uninjured by running dry; a cooker made in two sections—an oven and a hob-table, which can be used separately or together—this being the newest type; a large double oven range; and various designs of fires, hot-plates, kettles, toasters, &c.

The principal feature of the apparatus, as now standardised, is the care devoted to the design of the electrical heating elements and their connections. No mica is used in the cookers, its place being taken by porcelain; no flexible connections with bead insulators are used, stout iron strips rigidly fixed in place being adopted; and no connections pass through the linings of the ovens. The heating elements consist of wire wound on fireclay formers, which are supported so as to give perfect freedom for expansion and contraction, and the design is such that short circuits are practically impossible, while the heating elements are readily replaceable. The electrical circuits of these apparatus can withstand a test pressure of 2,000 volts. Where connections must be flexible, as in the case of the hinged hob-tables, they are enclosed in stout metallic flexible tubing. There are no mechanical contact joints in the iron strip connections; the joints are *welded*. Each section is protected by a fuse, so that one breakdown does not put the cooker out of commission.

It is highly interesting to note that 200 artisans' dwellings which are being erected in the north, are each being fitted with a Jackson electric cooker, wash-boiler, and two fires, on a commercial basis in competition with gas and coal; by their use, a saving of £30 is effected in the cost of each building. Thus the blessings of electrical methods are at last being brought within the reach of every class of user.

The purpose of the showrooms is to assist electricity supply authorities and contractors in educating their clients in the use of electrical appliances; to further this aim, the office staff is catered for in a separate kitchen, where cooking goes on every morning, while cakes, &c., are baked in the demonstration kitchen in the afternoon, and visitors are welcomed to witness these operations. Moreover, contractors may send their clients in person to the showrooms, to select and purchase apparatus, with the certainty that their full trade terms will be reserved for them upon each transaction, even if their clients call without the contractors' knowledge.

The company is willing also to explain in detail the various apparatus to contractors and their assistants, to prepare complete schemes for both large and small installations, on behalf of the contractor or the supply undertaking, and to assist architects, hotel proprietors, &c., with full information regarding the possibilities of electrical cooking and heating. While Mr. Williams himself possesses a wealth of experience in this subject, it is interesting to add that the company has secured the assistance of Mr. W. A. Gillott, of Newcastle, whose unique experience will be devoted entirely to the company's interests.

We have not by any means exhausted the subject, but would advise our readers to pay a visit to the showrooms. A new catalogue has just been issued, containing *inter alia* a detailed specification of the Jackson apparatus—a novel feature. In conclusion, we give in figs. 3 and 4 views of the interior of the company's works at Luton, from which it will be seen that the company does not *make* stoves; it *manufactures* them.

Figs. 3 and 4.—Interior of Luton Works of the Jackson Electric Stove Co., Ltd.

The British Empire Exhibition.—We have received a communication from the British Empire League, regarding the proposed Exhibition of British products and manufactures which will really be a commercial celebration of Peace. The Government has decided to give the Exhibition all possible support, guaranteeing £100,000, subject to £500,000 being guaranteed by the commercial community. Already some of the principal banking, trading and industrial concerns of the Empire have come forward as guarantors, and it is hoped that all leading commercial houses will participate in the Guarantee Fund. A strong Executive Council and Administrative Committee have been formed. Mr. C. Freeman Murray, Secretary of the League, has been appointed Joint Hon. Secretary of the Guarantee Fund Committee of the Exhibition. The organisation has been completed, and there is every reason to believe that the Exhibition, which is to be held in 1923, will be a pronounced success. Everyone interested in the unity of the British Empire will agree that a display in London of its vast resources in mineral wealth, food products, raw materials and manufactured goods, must, as was pointed out by the late Duke of Devonshire, the first President of the British Empire League, result in "better commercial relations, by means of improved communications, by means of increased sympathy with each other, of increased knowledge of each other."

Industrial Development in India.—It is the intention of the Government of India to foster local industries in every possible way, and the granting of financial assistance in the form of a guarantee of dividends, contributions to share capital, loans of money, and agreements to purchase outputs, are amongst the proposals in aid of new undertakings. Steps are being taken to encourage in India the manufacture of machinery and other articles which are now being imported, and preference in the placing of orders for Government requirements will, where possible, probably be given to local manufactures. The demand for machinery and engines is being studied with a view to standardisation and ultimate manufacture in India.—*Board of Trade Journal.*

ELECTROSTATICALLY CLEANING BLAST-FURNACE GAS.

By A. HUTCHINSON and E. BURY.

[*Abstract of paper read at the Autumn Meeting of the* Iron and Steel Institute *at Cardiff.*]

The ultimate rough cleaning of blast-furnace gas at Skinningrove for combustion processes has always been an essential consideration during the last ten years as making for fuel economy in the production of iron and steel. In seeking these economies the authors discussed the possibility of the successful application of electrostatic methods to Cleveland blast-furnace gas with the late Mr. Greville Jones, of Port Clarence, and together finally decided that Messrs. Bell Bros. and the Skinningrove Co. should erect a semi-large-scale plant at Skinningrove employing the discharge system invented by Sir Oliver Lodge. The plant was put to work early in 1917. The experiments were conducted on gas from the downcomers, under normal furnace conditions of temperature, pressure, dust and water content, &c., and convinced the authors that the method could be successfully applied on the large scale, if due regard were paid to careful direction of the gas flows over the discharge surfaces, with a similar regulation of the electric discharge from all points. The investigation was carried out over a period of three months, upon which it was decided to erect a plant for the treatment of the entire make of blast-furnace gas, *i.e.*, from 3,000 to 3,500 tons of pig iron per week.

In the design of the large-scale plant, very little data existed as a guide beyond the vital importance of carefully regulated gas and electric flow and a maximum speed limit of gas flow of 3 ft. per second. Furthermore, there was no standard degree of gas cleaning which could be fixed to guarantee clean stoves, boilers, and checkers. In determining the size of cleaning plant to be employed, it was desired to keep the capital expenditure within the limit required for rough cleaning, bearing in mind that the Theisen plant for the gas-driven power station at the works was already in existence and would always have to be employed to wash and cool the proportion of the gas required for that purpose. All that was necessary, therefore, was to clean the gas adequately for stoves, boilers, and other furnace work, and for these purposes 0.3 gramme of dust per cu. m. in the cleaned gas was ultimately fixed as an arbitrary standard. Recent investigation at Continental works, where rough water washing for stove and boiler use is almost universally employed, has shown that the desired end can be obtained by a higher dust content in the cleaned gas, instances being on record where stoves had not been cleaned for five years with a dust content of approximately 1 gramme per cu. m. in the water-washed gas. Since the start of the full-sized electrostatic plant at Skinningrove last Easter, the dust content has been reduced from 5 to 6 grammes per cu. m. in the raw gas to 0.8 to 1.1 gramme in the cleaned product, at which figure no deposit of dust has taken place in the flues since the plant started work. It should be specially mentioned that this result has been attained with 15 to 20 per cent. of the electrostatic plant out of action owing to difficulty in obtaining electrical equipment, spare transformers, &c. With the complete plant at work it is expected to maintain the dust in the cleaned gas at 0.5 to 0.7 gramme per cu. m., which will serve amply the purpose for which the plant was erected.

The vital necessity of carefully regulated gas flows as being essential to successful electrostatic treatment demands great emphasis. In this method of gas cleaning the gas passes without restriction of any kind through nests of rods and plates, which are perfectly open and offer no resistance to the gas as in the case of filters or powerful sprays of water. The danger of gas slipping through the treatment chambers uncleaned is, therefore, much greater in electrostatic methods than is the case with water-spraying or filtration plant. Recognising this difficulty, the electrostatic plant at Skinningrove was designed to split up the gas make and flow through sixteen cleaning units, further subdividing the flow in each chamber through adjustable bafflers, so that the gas would flow evenly over the discharge grids both in horizontal and vertical planes. As a further precaution the inlet of each chamber was designed so as to deliver the gas equally over the vertical and horizontal planes of the discharge surfaces, a similar arrangement being adopted at the chamber outlet in collecting the gas for delivery into the clean gas main. It was elected to regulate the flow of gas through each chamber by adjusting the outlet valve which, being clean, would not clog up and upset the gas flow.

Of equal importance is the equalisation of the electrostatic field throughout the chambers, since any short circuiting would militate against equal treatment of the gaseous atmosphere. The Lodge Fume Co., which is responsible for the electrical equipment of the plant, has provided against this eventuality by supplying each chamber with two sets of discharge grids in series, each with its own transformer set. Each set of grids is provided with 7,000 discharge points, that is, 14,000 points to each chamber, so that the electrostatic field is evenly distributed throughout the chambers. Short circuiting has taken place from time to time, but has invariably been the result of irregular cleaning of the grids; such difficulties will disappear as the practice becomes standardised.

The authors regard the above considerations as of utmost importance in the successful application of electrostatic methods to cleaning blast-furnace or any other gas.

That the risks of explosion would be great in passing electric discharges through a combustible gas, in the event of sparking, would certainly be the case if the gas were mixed with air so as to provide an explosive mixture. It so happens, however, that the whole system is under pressure from the furnaces, and air admixture is impossible unless minus pressures are incurred. Against the latter eventuality there has been provided an automatic switch which cuts off the discharge if dangerous minus pressures occur. Under no circumstances has an explosive condition been approached in the main system, although care must be exercised when "bleeding out" individual chambers (*i.e.*, replacing gas by air for cleaning purposes) to cut off the electric discharge. Through neglect of this precaution a few weak explosions have occurred, which, however, were perfectly harmless.

The following points require special emphasis: It is strongly recommended that the electrostatic system should be placed on a by-pass flue, especially where all sections of the works are interdependent, as at Skinningrove. To make this policy complete, flues and pipe connections have been built so that stoves, boilers, and power-gas washing plant can be supplied instantly either with electrostatically cleaned gas or dirty gas.

The multiplicity of chambers was adopted to ensure maximum contact between the electrostatic discharge and the gas to be cleaned, by splitting up the gas flow into multiple

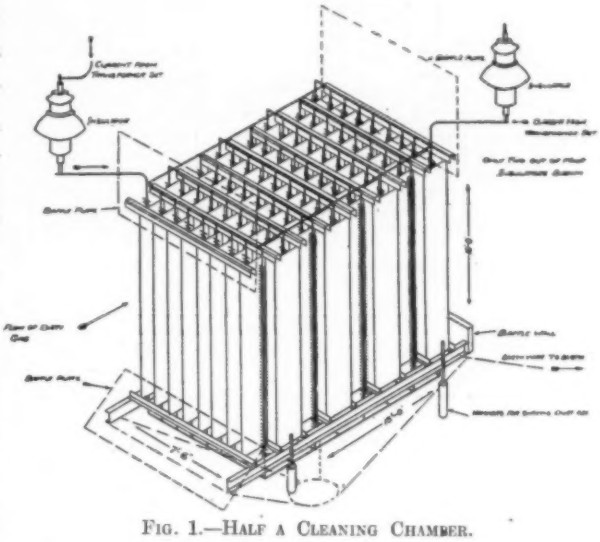

Fig. 1.—Half a Cleaning Chamber.

streams; also to avoid passing large quantities of dirty gas into the system when cleaning the chambers (during which operation the discharge must be cut off), which would have been the case if a smaller number of larger chambers had been employed. The same remarks apply to chambers off for electrical repair or alterations.

The thirty-two transformer sets are placed in a building immediately above the cleaning chambers, so as to shorten the lead of H.T. cable conveying the uni-directional current to the discharge grids in the cleaning chambers, thereby reducing the amount of electrical leakage to a minimum. By this disposition of electrical plant the current consumption has been kept down to 50 kw. for treating the entire make of gas from 3,000 tons of pig iron per week. Each cleaning chamber is provided with two cleaning hoppers, situated under their respective discharge grids. Each grid is provided with rapping gear, operated by leavers, which during the cleaning operations shakes the discharge plates and precipitates the dust into the hoppers, whence it is removed by scraper conveyors to the potash extraction plant. The operation of cleaning each chamber takes place every eight hours, for which purpose the gas and electricity are cut off, the discharge plates rapped, and the dust is withdrawn from the hoppers to the conveyors. Fig. 1 shows one half of a cleaning chamber.

The erection of the plant was commenced during the latter period of the war when constructional steel was practically unobtainable, and the gas chambers, gas mains, transformer and potash buildings were, therefore, constructed of ferro-concrete; at first the ability of ferro-concrete to stand temperatures up to 250 deg. C. was doubted, but the authors

would not now hesitate to employ that material for similar work at temperatures up to 300 deg. C. The ferro-concrete construction was by the Simon Carves Co., of Manchester.

The building consists of three distinct structures. On the bridge over the railway tunnel are two scraper conveyors for moving the dust from the 32 hopper valves to the storage and mixing tanks, situated under the far end of the bridge. Resting on the bed girders of the latter but not structurally attached to it, are the dust depositing chambers B, allowance for their independent expansion under the influence of the hot gases being made by means of cast iron sliding shoes and seats at x x, fig. 2.

Baffle plates are provided at the top and bottom of either end of the 16 chambers; each of the latter is fitted with an inlet valve D, and a double outlet valve E, composed of a set of sliding grids F for regulating the amount of gas passing the chamber, and a mushroom valve G direct on the clean gas main. There are four explosion doors H at either end, a manhole with explosion door in the roof J, and a dust discharge valve K in each of the two dust bins with which each chamber is provided. The bins hold about ¾ ton of dust. The hot dirty gas passes to the chambers from the underground main by a vertical circular ferro-concrete pipe, and thence by a horizontal main L, rectangular in section, to the chambers. This main is provided with hoppers and dust shoots, so that it can be cleaned of dust without interrupting the operation of the plant. It is built in six sections with telescopic joints to allow for expansion, and is carried on cantilevers, on some of which it is free to slide during expansion. The cleaned gas leaves the chambers by a circular main M with similar provision for expansion.

Above the chambers is the insulator floor N, carrying the insulators S, which transfer the current from the Lodge H.T.

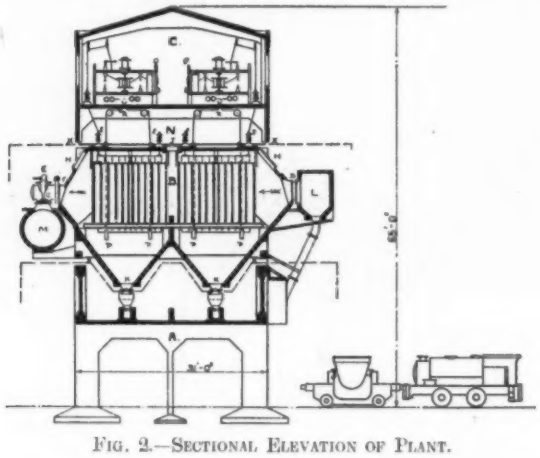

Fig. 2.—Sectional Elevation of Plant.

transformers O in the transformer house C. The hammer gear for vibrating the plate electrodes in the chambers is shown at F and R. Each chamber is furnished with two electrical units, each consisting of a transforming set, and a set of 85 plate electrodes.

At the time the plant was projected it was almost impossible to obtain plates, and ferro-concrete was used for the structure, a further advantage being that there would be much less radiation than with steel plates. In view of the high temperature in the chambers, rising at times to the neighbourhood of 300 deg. C., which would occasion heavy stresses, exceptional care was taken in the design and construction of the ferro-concrete.

The potash extraction plant consists of mixers for lixiviating the soluble salts from the dust (chlorides of potassium, sodium, and calcium), revolving filters for separating the insoluble matter from the soluble chlorides and two Kestiner evaporators. Only very minute traces of sulphate are present, and carbonate and cyanide not at all. The methods of separation used are: (*a*) removal by direct evaporation of the potassium and sodium chlorides from the calcium chloride; (*b*) separation by fractional crystallisation of the potassium and sodium chlorides.

In the extraction of potash from the deposited flue dust, the dry dust from the conveyor is lixiviated with water or wash liquor as it falls from the conveyor chute into the concrete slurry tanks below the electrostatic plant. In the mixers, which are provided with efficient stirring arrangements, the slurry is boiled and then continuously run down on to a series of revolving vacuum filter drums below the mixer. The dried cake containing about 30 per cent. moisture is cut off by a steel knife placed in such a position that the cake flaked off from one drum falls into the well of the next, where it is each time boiled with a weaker liquor, and the last cake, free from soluble salts, is transferred by a worm conveyor to railway trucks outside the building, whence it is returned to the blast-furnaces.

The strong liquor containing KCl, NaCl, and CaCl is transferred to the feed tank for the preliminary evaporator, where it is heated by indirect steam, and then continuously fed into a Kestner salting evaporator, in which the separation of the sodium and potassium chloride from the calcium chloride takes place. When the saturation point of the three salts is reached, the evaporator is emptied and the cycle started again. The residual liquor is evaporated to dryness in open pans heated by breeze fire.

In the preparation of potassium chloride from mixed salts, the mixed crystals are dissolved in hot distilled water or liquor from the final evaporator, from which they pass through a filter and then into the feed tank, and finally into the evaporator. Evaporation is then commenced, during which potassium chloride crystallises out and more liquor is added until the evaporator is completely full of liquor of the required density, at which point the whole contents of the evaporator are run out and passed through a revolving crystalliser, more potassium chloride being deposited during the cooling. The sodium chloride is removed from the evaporator by means of the vacuum filter box, and the clear liquor run through the crystalliser, when potassium chloride again crystallises out. From this point the process is cyclic, sodium chloride crystallising out on evaporation and posassium chloride on cooling.

The plant has only been at work since April 8th last, but in view of the keen interest universally displayed in gas cleaning, the authors submit their results so far as they have been obtained, with the promise of adding their further experience when acquired. In the meantime they are content to have so far proved the following points with regard to electrostatic rough gas cleaning at Skinningrove:—

(*a*) That with 80 to 85 per cent. of the electrostatic plant at work (remainder awaiting electrical equipment), the dust in the gas has been reduced from 5 to 6 grammes per cu. m. in the dirty gas, to 0.8 to 1.1 gramme in the cleaned gas; or, in other words, to the standard of Continental practice for stove and boiler use.

(*b*) That the above result has been attained with a total fuel consumption corresponding with 50 kw. only.

(*c*) That no power is necessary for pumping water or for moving gas through the system.

(*d*) That the cleaning has been effected by a comparatively small loss of the original sensible heat. The raw gas enters the cleaning chambers at 220 deg. to 250 deg. C. and the cleaned gas leaves at 200 deg. to 220 deg. C.

(*e*) Less gas is being used at the stoves and boilers, but it is too early as yet to state the total saving accurately. All that can be stated is that the surplus gas available has increased; the exact economy can only be determined when all stoves, &c., have been cleaned and the clean gas given a fresh start.

(*f*) The recovery of 48 to 50 tons of dust per week containing 27 per cent. KCl.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The E.P.E.A. and the E.T.U.

The foolish statements made in your "leader" in the current issue of the Review in regard to the E.P.E.A. only endorse the impression ,long held by many, that the Electrical Review is little more than an employers' organ during industrial disputes. The E.P.E.A. has acted in a constitutional manner in this crisis, and has acted to an agreed policy in connection with disputes in which the members may be involved.

Judging by the biased style of the "leader," the Electrical Review is quite in sympathy with the gang of chief engineers who not only will not honour agreements made by the Joint Boards when they disagree with its findings, but are out to deliberately break up the E.P.E.A. No doubt the E.R. would like to see the Association in a cleft stick between employers and workmen, but the "executive" are too intelligent to be put in that position. To be absorbed by the E.T.U. may be terrible, we have not had experience of it, but it can't be much worse than being submerged by chief engineers who are only out to exploit them. They need a protective organisation, and they have one. It has come to stay, and will make itself felt when others adopt attitudes which are against the policy of settlements by negotiation.

Se Defendendo.

September 18th, 1920.

The letter from "A Group of Senior Power Engineers" in your issue of the 17th inst. seems to indicate a desire for the resuscitation by the E.P.E.A. of a policy long ago abandoned as untenable. In the early days of this Association the greater number of the members were to a great extent ignorant of the principles of trade unionism, and they failed to appreciate the fact that registration as a trade union involved,

ipso facto, certain obligations. They were quite willing to accept any benefits that were to be got, but the idea of their ever being called upon to employ drastic measures in any circumstances whatsoever was repugnant to them. Indeed, they believed such a contingency was too remote to merit more than a passing thought. The educative effect of the lessons of experience is clearly shown by the very different attitude of the members to-day. Slowly, reluctantly perhaps, they have awakened to a kind of class consciousness, and they have—if I may use the term—found their souls as trade unionists. Mahomet's coffin has yielded to the force of gravity, and is no longer poised in an unnatural position 'twixt earth and sky. The splendid isolation dreamed of in the beginning has been found impossible to maintain.

Nor is the reason for the change obscure. Speaking generally, the treatment of staff engineers by employers has not been calculated to retard the movement towards acceptance of orthodox trade union methods. At the present time efforts are being made by some undertakings to evade the decisions of the Joint Board, recently set up as a means of securing the redressment of grievances by constitutional action. This sort of thing drives home the conviction that, without the weapon of drastic action in the last resort, and the will to use it, there is not much hope of securing justice. However, the use of the strike weapon is not a course which the bulk of staff engineers take to kindly, and the Executive Council of the E.P.E.A. pins its faith to the principle of exhausting every possible constitutional means for the settlement of disputes in the electrical industry before resorting to drastic measures.

In the E.T.U. dispute, now happily settled, the attitude of our Executive has been entirely logical, and in consonance with this principle. It did *not*, pace your correspondents' assertion, "overlook the fact that the dispute was originally precipitated by the action of the E.T.U. at Penistone." With the merits of this dispute the Association had no concern, nor did it, in fact, take any cognisance of it. What did concern the E.P.E.A., however, was that, the trouble having spread to the supply industry, its own members became involved. Acting on its fundamental principle of maintaining constitutional methods, whenever possible, the Executive was prepared to give its support to the side acting in accordance with its declared policy. It had no alternative. Either it must adhere to its own deliberately formulated principles or else confess its futility by abandoning them in the very first crisis. As it turned out, it was the E.T.U. that consented to arbitrate, and the Employers' Federation that chose the line of direct action. Here was a perfectly clear issue. It was not a question of a dispute at Penistone or of the justice of involving the supply industry at all. The industry was already involved, and I hold that the action of the E.P.E.A. was perfectly correct in every particular.

I strongly disagree with your correspondents' statement that the Executive Council of the E.P.E.A. "holds the view that because we are a trade union we must throw in our lot with any other trade union in any strike that may develop, provided the grounds seem to us to be just." They claim to speak with knowledge, but their information appears to be decidedly open to question. More strongly still do I disagree with their paraphrase of the statement quoted: "In other words, we declare beforehand our sympathy with the men as against the employers." I should have imagined—perhaps I am obtuse—that *any* cause which is *just* should command the sympathy of all right-thinking men.

Where have those "Senior Power Engineers" been hibernating? They seem, like the Bourbons, to have learnt nothing and forgotten nothing. Their minds are still functioning in the dim obscurity of the past, when the E.P.E.A. was in swaddling clothes. Moreover, if, as members of that Association, they do not wish to loyally support their Executive, then what are they doing in this galley? They are only *in* it; not *of* it. They "cannot accept"; they "refuse to be coerced," &c. Well, no one at present is going to ram the unpalatable bolus down their several œsophagi. We prefer constitutional methods where possible, though we reserve the right to employ sterner measures in the last resort. No, we shall rather trust in this instance that the dawn of intelligence will shortly begin to lighten the mental darkness of this agitated "Group of Senior Power Engineers."

Another Power Engineer.

September 18th, 1920.

Like many other loyal engineers, I received something like a shock during the past week, when I read in both the penny and threepenny editions of one of your lay contemporaries, that the E.P.E.A. were about to throw in their weight against national interest and oppose loyalty and duty.

However, I was in the neighbourhood of Fleet Street last Wednesday evening, and learnt many things which were evidently without the knowledge of the writer of your leader under the above heading which appeared in your issue of September 17th. Now Chancery Lane is not very far from Ludgate Hill, and I submit that before you publish remarks on a delicate subject, you should ascertain the facts. In spite of camouflage on 15th inst., you were in a position to ascertain the essential facts from any "tame monkey" you happen to know, even if you had been driven to the telephone. Now, Sirs, I am an obscure member of the Association of "tame monkeys." Not even on a single section committee. Wherefore I drop this subject, but hope an abler "monkey" conversant with all the facts will prevail upon you to withdraw the gross misstatements you have published in a technical journal. I believe in the past your useful journal has advocated Whitleyism, which I personally commend to you and to "A Group of Senior Power Engineers."

The president of the I.E.E. can be trusted to think before his voice is heard.

Investigation will prove to you that the action of the Executive Council of the E.P.E.A. was the determining factor in securing peace.

Walter E. Rogers.

London.

September 17th, 1920.

[We have in the past championed the cause of the Electrical Power Engineers' Association so consistently that we have no fear that we shall be classed amongst its enemies; but we shall not forgo our right of honest criticism, and we do not take back a word that we have said. As for the reference to "monkeys," we suggest that Mr. Rogers should cultivate a sense of humour; no one could reasonably suppose that we called the Association, or any member of it, a monkey. With regard to the accuracy of our statements, we had first-class authority for our conclusions, which, moreover, were supported by the letter from "A Group of Senior Power Station Engineers" in our last issue. Naturally, as we go to press on Wednesday, we cannot give the results of meetings held that evening and the following day in our Friday issue.—Eds. Elec. Rev.]

The leaderette in the current issue of the Review is welcomed by a large section of the E.P.E.A. as a fair expression of their views. Many of the members are absolutely disgusted at the way the secretary and his staff have conducted affairs, thereby placing the Association in a position from which only good fortune extricated it. The E.T.U. were not slow to take advantage of openings given, and it is most pitiable that a professional association should have been dragged along by the nose by the most unconstitutional organisation of the day.

It is much to be regretted that the Association is not adhering to the original programme as sketched out by Mr. Wordingham; instead of attempting to raise the status of the members, the opposite seems to be the policy. For some time past there has been far too much coquetting with the E.T.U., and a section openly advocate throwing in their lot with that body. It is only fair, however, to add that this state of mind has been largely brought about by the way certain employers have treated the Association. Even to-day many undertakings have not honoured their promises to abide by the award, so it is not altogether surprising that the "Red Heads" have made their voices heard. If we had strong men to conduct affairs, many of the difficulties encountered would be scotched at their inception, but, unfortunately, this is evidently not the case. The E.P.E.A. is an Association which is badly wanted by both employer and employé, but the men who conduct affairs must command the respect of both parties, and until this is so the society cannot hope to take its proper place as representing the views of a group of professional men whose services are vital to the community as a whole.

Another Group of Senior Members.

September 20th, 1920.

It is unfortunate that the "Group of Senior Power Engineers" whose letter appears under the above title in your last issue, have not subscribed their names, as it would have enabled the Executive Council of the E.P.E.A. to provide them with a fuller explanation of the policy, than is possible within the narrow limits of a letter. It is certainly safe to assume, however, that they cannot have been in the habit of attending the general meetings of the Association, otherwise they would not have been guilty of such misleading statements as "the Executive Council of the E.P.E.A. holds the view that because we are a trade union we must throw in our lot with any other trade union in any strike that may develop, provided the grounds seem to us to be just." When and where did the Executive Council make such a declaration? As a matter of fact, no such assertion has ever been made, and their supposition is entirely erroneous. The support of the E.P.E.A. is not cast indiscriminately on to the side of the trade union, neither is it (as they apparently would desire) cast on the side of the employer, but is conditional upon either party consenting to make use of the regularly constituted machinery. If this is to "forfeit our independence" it is the inevitable consequence of our having to act as a trade union. We have been compelled by force of circumstances to use the strike weapon, and we have no right to act as an organisation of strike-breakers in every dispute. Those who are shocked at such heresy need to be reminded that nothing less drastic than a trade union could effect a cure for the intolerable conditions which existed before the E.P.E.A. entered the field.

The surprise exhibited by those senior engineers at the present conduct of the Association, and the splendid attitude of aloofness which they adopt, would be amusing were it

not for the fact that it reveals their own shortcomings. If they had taken a more active interest in the development of the Association, if they had given their intelligent assistance whilst the policy was being formulated, they might have guided the Association more in accordance with their desires. Or alternatively, they might have been educated up to the policy, and have ranged themselves in line with the bulk of the Association which supports the policy, for it is significant that the small majority of the members who to-day find themselves in disagreement, is largely made up of those members who have assisted least in the development of the Association, and who have consistently absented themselves from the meetings.

W. Arthur Jones,
General Secretary,
London. *Electrical Power Engineers' Association.*
September 21st, 1920.

Imitation Half-watt Lamps.

May I give warning that there are now on the market 30- and 40-watt, 200-250-volt lamps which have the appearance of, and are being sold as, "half-watt type" lamps, but which are not gas-filled, and their efficiency is little if any higher than that of over-run, one-watt lamps.

B. B. Gothard,
Electrical Engineer.
Aldershot, Electricity Works.
September 20th, 1920.

Power Factor.

The correspondence on power factor is stimulating and enjoyable. May I add that, before sending the first article, I submitted it to an eminent authority, and his opinion was not that of Mr. Dorey. Mr. Dorey seems to have a poor opinion of the utility of apparatus for producing leading P.F. to compensate for the lagging P.F. which so curses most stations, but he is not supported by leading authorities in this. For instance, Glover's Almanac for August 20th records that one station installed a 7,880-K.V.A. synchronous converter to compensate for lagging P.F. with good results. Mr. Dorey objects to my statement that a firm might get 1,000 K.V.A. wattless current for nothing, and points out that such a firm would be using something like 3,000 KW. of wattful current. Quite so; but surely the firm which uses 3,000 KW. at unfty P.F. should get it at a better rate than one which uses 1,000 K.V.A. wattless along with it. The suggestion to use a demand indicator to register K.V.A. is well known, but it is also unfortunately equally well known that consumers hate the maximum-demand system most bitterly. They fear that some day they will be let in for a high maximum demand through some exceptional concatenation of circumstances, and they prefer to pay for all their current in units. The method of assuming 80 per cent. P.F. is not scientific; it gives a man no inducement to improve his P.F. and provides no penalty if the P.F. drops to 30 per cent.

A meter expert has written me that meters are procurable which will meter the "wattless component." For large consumers these should be the best solution. The wattless-component meter reading is made use of to modify the main meter reading in a suitable manner, and this gives a method which is fair to everyone. The K.V.A. meter suggestion is not fair, being altogether too severe.

Mr. Harvey thinks that some technical men are irritated by the analogy business. Granted; but some are not. Clerk Maxwell, Kelvin, and Duddell all had some fondness for the mechanical analogy, while Dr. Drysdale, in his text book, uses it through and through, and deduces his formulæ mechanically and then adapts them to electricity. The result is satisfactory to most people.

If the Editor will allow me, I propose to write a third article on the subject, from a different point of view. In it I hope to show that Mr. Harvey's ideas of wattless current are wrong. At any rate, if they are not, then most people who have written on the subject have gone wrong.

C. Turnbull.
Electricity Works, North Shields.
September 14th, 1920.

Electric Welding.

The writer of the article upon the above matter in this week's issue makes a few statements which are apt to mislead those who are thirsting for knowledge upon this important subject. In the first column he points out that 60 has been agreed upon as a suitable generator voltage for arc welding, and that the earlier specified 100 volts is unnecessary. In this he is correct, but in the second column he states "60/80" volts as quite satisfactory, while further on he rises to 90 volts. In the third column it is stated that a generator should be selected having a range of "30 to 100" volts.

In the second column, the voltage for a bare metal arc is given as "25 to 35." Even the lower figure here is too high for bare metal, while the higher would mean a very long arc and a spongy deposit. A bare metal electrode in the hands of a skilled operator should never exceed 22 volts, while 18 and 20-volt arcs are quite usual. Manganese steel electrodes do not require any higher voltage than mild steel, and the figure of 300 amperes named for the current is far too high for any gauge of electrode in common use. No. 4 gauge is the largest, and the current here should not exceed 200 amperes.

A slag-covered electrode may require a higher initial or generator voltage, but the arc potential will be consistent with that of the uncovered electrode. It is only when the flow of the pools of molten slag threatens to wash out the arc that the higher initial voltage serves to maintain it.

In describing the reverse-compound-wound arc welding generator, the writer omits to state that separate excitation for the shunt winding is necessary. Without it, the machine would be a failure, owing to the heavy rush of current upon striking the arc demagnetising the fields, or even reversing the permanent magnetism. It should also have been pointed out that these machines are only suitable for supplying current to one arc.

The writer states that 5 KW. per welder is sufficient for average conditions. If 60 volts is the accepted line pressure this would allow each welder 83 amperes, which value does not agree with the other figures given. If the allowance is based upon the assumption that self-regulating machines will be used, the figure would suffice for light welding, but this should have been stated.

H. Bevan Swift.
London.
September 18th, 1920.

Domestic Supply Pressure and Wiring.

No reader of the REVIEW should miss the long and valuable article by Mr. C. H. Wordingham in your issue of the 17th.

One may hope that the Wiring Rules Committee will give every attention to the question of "Graded Regulations," and that the coming session of the I.E.E. may produce some paper which will permit of discussion on the lines of the Past-President's suggestive communication.

The cooker with self-contained transformer sounds revolutionary, and may entail metering difficulties, but reversion to higher distribution and lower consumers' pressures does appear imminent.

The suggestion that loss of energy in the form of heat in wiring used for electric stoves is not necessarily waste leads one to a convector method of warming in which low-temperature elements are distributed over the room, *i.e.*, the conductor cable and heating element tend to merge into one another; however, a large proportion of our occasional heating will no doubt continue to be effected by radiation; the cheerful and healthy characteristics of high-temperature radiation have given the modern electric stove its popularity.

The basis of simplified house wiring must lie with a reformed tariff system; once secure a method of payment by some form of subscription or assessment, with a uniform rate for all energy through a single meter, and many improvements become possible.

A rising main, looped into each floor or room, and multiway outlets to which local lighting, heating, and power can be connected, immediately suggests itself. Instead of plugging a 600-watt kettle into a 60-watt lamp socket, we shall then plug the local lighting circuits and all small consuming devices into a receptacle attached to the main heat terminals for the floor or room in question.

Given a low-tension supply (say, 50 volts) on the consumer's side of the meter, and it becomes worth while to consider even wiring the house by running cable up outside the walls and looping into a terminal box on each floor; considerable modifications in practice would result, and much greater freedom could be given in the design and use of all accessories. To-day we encumber the work with costly safeguards, and when the job is finished the consumer buys perhaps a washing machine, with but partly protected motor and leads, which she proceeds to use without any earthing provision in a scullery slopping with water, and bristling with taps and metal work, which are handled whilst working with the washer and its connections.

J. W. Beauchamp,
Director and Secretary,
London. *The Electrical Development Association.*
September 20th, 1920.

The thanks of all who are interested in the future of the electrical industry are due—and no doubt will be accorded—to Mr. Wordingham for his article in last week's REVIEW. I have no doubt it will be regarded as a landmark in the history of electricity supply, not so much for the blessing he bestows on cheap wiring, but for his daring act in exploding a bomb in such close proximity to that sublime and stately edifice—the I.E.E. rules.

In politics the meaning of a move of this nature would be obvious to all, and it is to be hoped that in this instance the object in view is the same.

The I.E.E. rules are admirable in themselves, but they are not easy of sensible application by the stupid and inexperienced. In other words, in the hands of the experienced and conscientious they are a safeguard, but when entrusted to fools they are the cause of endless futility. As an instance, the

regulations say that installations in certain cases must be controlled by a double-pole linked switch; this was recently interpreted by a supply authority, in such a manner that they refused to connect a seven-light job, as two single-pole tumbler switches had been used, and this presumably with the concurrence of the chief engineer.

One of the unpleasant features in the application of any set of wiring regulations becomes prominent when these are placed in the hands of a supply authority who are in possession of wiring powers, and therefore in a position to compete with those whose work they have to pass. The limited powers of supply authorities are not generally known, and I doubt the advisability of allowing the matter to be generally realised, as it would tend to encourage undesirable wiremen in their campaign of shoddy work, and add another "bayonet" to the side of the engineer. It is, however, very galling to find trivial omissions or deviations from the I.E.E. rules, in unimportant installations, being made the excuse for refusal of connection, which can but tend to discredit the contractor in the eyes of his client.

The remedy for this is that all inspection be taken from the hands of the supply authority and entrusted to an independent trustworthy and experienced inspector, who would be directly responsible to the Commissioners. It should be made compulsory for all contractors *and supply authorities* to notify the appointed inspector of all work in progress, and a certificate from him on completion should be taken as a guarantee that an installation was suitable for connection.

The present system, as practised in some districts, of entrusting the inspecting of installations to inexperienced youths, who are also responsible for subsequently connecting those installations, is so obviously unsound and unfair that it is incredible that it should be allowed to exist.

I will not elaborate this point further at present, but will leave it in the hope that others of your readers will express their opinions, on the matter.

Thomas Smith,

Smith & Bellhouse, Wolverhampton.

September 20th, 1920.

BUSINESS NOTES.

Bankruptcy Proceedings.—*Re* J. J. Symons (trading as the Zodiac Peerless Electric Lamp Co., 25, Denmark Street, Charing Cross Road, W.C.—The first meeting of creditors under this failure was held at the London Bankruptcy Court, on September 16th, before Mr. Walter Boyle, Official Receiver. A statement of affairs was presented showing unsecured liabilities £2,200 and assets valued at £216. The Chairman reported that it appeared from the debtor's statements to the Examiner that he was formerly in the employ of an electrical company, and there gained a knowledge of the industry. In October, 1918, he entered into partnership with his father, and they started business as electric lamp factors under the above style. They jointly provided a capital of £200 at the outset, and his father subsequently advanced a further £200 for the business. The partnership was dissolved in November, 1919, on terms that the debtor took over the business, with the liabilities and assets, and gave his father a bill for £200 in consideration of his interest in the business. The debtor continued the business in the same name, and commenced to manufacture lamp shades in addition to the lamps. He obtained good orders, and, as he acted as his own traveller, he left the management to employés, through whom he lost a considerable sum; a further £200 or £300 was lost through a burglary, in consequence of which he had to cancel orders and return certain goods. A private meeting of the creditors was held last August, when the creditors demanded 10s. in the £; the debtor was unable to arrange that composition, and these proceedings ensued. He attributed his failure to bad trade; to fall in value of a large stock of materials in hand; and to the loss by burglary. A resolution was passed for Mr. A. H. Partridge, 11A, Warwick Court, Holborn, to act as trustee and administer the estate in bankruptcy. The following are the principal creditors:—

Garrett & Co., W. J.	£747	British Thomson-Houston Co., Ltd.	£45
Perrott & Sons, W. K.	573		
Scott, Son & Co., Ltd.	571	Sloan Electrical Co.	30
Symonds, J.	214	Stanley Palmer	10

A. R. Meggett, electrical engineer, 45, Thrumpton Lane, East Retford, Notts.—The public examination of this debtor was held on September 16th, at Sessions House, Lincoln. Debtor's statement of affairs showed gross liabilities of £692, of which £677 was due to unsecured creditors, and assets of £278, leaving a deficiency of £399. Debtor attributed his failure to want of capital and to cost of time of man when awaiting delivery of material. Debtor stated that he was apprenticed to a firm of electrical engineers at Birmingham, and after serving his time he worked on his own account as a journeyman until December, 1919, when he opened a business at Retford with a capital of about £20. He filed his petition on receiving a County Court execution levied on his effects for £22. He had kept no books. He had entered into contracts, one of which was for £300. His total contracts during the short time he was in business amounted to about £1,000. He believed he had always under-estimated in making out these contracts. Further questioned, debtor said that when he had had executions or County Court summonses his father-in-law had paid them out. The examination was formally adjourned.

H. Turner, electrician, 31, St. Paul's Road, Southsea.—Receiving order made September 15th, on debtor's own petition.

W. H. Mellon (H. B. Wallis & Co.), electrical engineer, Chiswick.—First and final dividend of 2s. 5d. in the £, payable September 22nd, at Official Receiver's Office, 14, Bedford Row, W.C.

A. S. Palmer, journeyman electrician, Margate.—First and final dividend of 1s. 2¼d, in the £, payable September 25th, at the Official Receiver's Office, 68A, Castle Street, Canterbury.

Catalogues and Lists.—Messrs. Jones & Pordes, 8, Crawford Passage, Farringdon Road, E.C.1.—New issue of "Elba" dry cell leaflet.

Messrs. Mavor & Coulson, Ltd., 47, Broad Street, Mile End, Glasgow.—A collection of 40 illustrated leaflets dealing with many types of industrial switchgear, &c., including ironclad and flameproof installations for mines, A.C. and D.C. switchboards, distribution pillars, joint boxes, tramway type controllers, &c.

H. W. Sullivan, 368 and 369, Winchester House, E.C. 2.—A catalogue (15 pp.) of "Sullivan" electric fires and grills of many patterns. The list is fully priced and illustrated.

Columbia Steel and Engineering Co., Ltd., 329, High Holborn, W.C.1.—A booklet (23 pp.) dealing with bright, cold rolled, free cutting mild steel, and turned and polished shafting. Illustrated table of metric equivalents.

The General Electric Co., Ltd., 67, Queen Victoria Street, E.C.4.—List No. W K 43 (8 pp.). A well illustrated publication dealing with "Witton-Kramer" electric monorail hoists, &c., and including worm-geared and spur-geared winches, electric friction hoists, and electric capstans, with leading dimensions, speeds, H.P. of motors, lifting capacities, &c.

The Electrical Supplies Co., The Light-House, 233, Tottenham Court Road, W.—Sheets 51 to 54 dealing with alabaster bowl fittings, ornamental lighting brackets, standards, &c. Also a net trade price list (8 pp.) covering a wide field of electrical fittings, &c., from accumulators to cables, conduits, switches and plugs.

Rhodes Motors, Ltd., Riverside Works, Doncaster.—Stock List, September, 1920, giving particulars of D.C. and A.C. motors for sale.

"Welco Patents," 150, Alma Street, Birmingham.—An illustrated and priced leaflet of electric fires in antique copper or oxydised silver finish.

William Bryce, 54 and 54A, Lothian Street, Edinburgh.—List of technical works (72 pp.), grouped under many headings and relating to electrical and mechanical engineering, building construction, &c.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W. 1.—A catalogue (32 pp.) of electrical cooking and heating apparatus, profusely illustrated, with price list. The publication deals with electric cookers, toasters, kettles, hot-plates, water-heaters, irons and various types of electric fires.

Company Liquidations.—Bombay Electric Supply and Tramways Co., Ltd.—Winding up voluntarily. Liquidators, Mr. F. C. Rimington and Mr. N. H. Moos, who are authorised to consent to the registration of a new company (Bombay Electric Supply and Tramways Co., Ltd.), which will acquire the entire undertaking as a going concern. Meeting of creditors, October 4th, at 3, Clement's Inn, W.C.

Gokak Water Power and Manufacturing Co., Ltd.—Meeting called for October 20th, at 9, King William Street, E.C., to hear an account of the winding up from the liquidator, Mr. W. Lethbridge.

Brolt, Ltd. (Incorporated 1911).—Meeting of members, October 25th, at 120, Colmore Row, Birmingham, to hear an account of the winding up from the liquidator.

Trade Announcements.—The *Financial Times* reports that at the meeting of the Humphrey Pump Co., held last week, the agreement between the company and William Beardmore & Co., for the sale of the patent rights of the water-column pump, was approved.

Messrs. Hyatt, Ltd., are removing on September 29th to larger offices at Thurloe Place, South Kensington, S.W. 7.

Mr. R. J. Clarke has transferred his business to 17, Great Brunswick Street, Dublin, not to 11, Townsend Street (which is his former address), as stated on p. 334 of our issue for September 10th.

The Institute of Cost and Works Accountants has removed to larger premises at 38, Grosvenor Gardens, Victoria, S.W. 1. A library is in course of formation for the use of members, and a reading room is being provided.

Dissolutions of Partnership.—Carrack, Cass and Timm, electrical engineers and contractors, 6, Park Place, Leeds.—Messrs. J. W. Carrack, W. H. Cass, and H. B. Timm have dissolved partnership. Debts will be attended to by Messrs. J. W. Carrack and W. H. Cass, who will continue the business under the style of Carrick & Cass.

Hills & De Lotbiniere, consulting engineers, 9, Victoria Street, S.W.—Major-General A. C. J. de Lotbiniere and Brig.-General E. H. Hills have dissolved partnership.

Newton & Co., manufacturers and dealers in lantern slides and slide boxes, 37, King Street, Covent Garden, W.C., and opticians and scientific instrument makers, at 72, Wigmore Street, W.—Mr. H. C. Newton and Mr. R. S. Wright have dissolved partnership. Debts due and owing to the King Street business will be attended to by Mr. H. C. Newton, who will continue the business at that address under the style of Newton & Co., and as to the Wigmore Street business by Mr. R. S. Wright, who will continue the business as Newton & Co., at 72, Wigmore Street, W.

C. Dales & Sons, watchmakers, jewellers, opticians, and electricians, 113, Poole Road, Bournemouth.—Messrs. C. and T. H. Dales have dissolved partership. Mr. C. Dales will attend to debts and continue the business under the style of Charles Dales.

Lead.—Messrs. James Forster & Co. report (September 18th):—

The Broken Hill smelters, as is now generally known, have intimated their inability to complete "average" contracts for September and October because of the strike. America is again on the market, and France is also a buyer.

Domestic trade has been falling off lately, but this week there has been quite a good demand for prompt lead, and some consumers have been buying for delivery up to the end of the year.

The settlement of the electrical engineers' dispute and the better prospects of a settlement in the coal trade should help all markets, and, not least, metals.

Messrs. G. Cawson & Co. report:—

The market has been erratic and unsettled, owing to labour troubles. The price fell as low as £34 10s. for distant months, while prompt remained at £35. From this point there has been quite a good recovery, owing to the settlement of the electrical workers' strike, and also a better feeling as to the prospects of settlement of the coal strike. The discount on forward lead has now disappeared, and lead in all positions September to December may be quoted £35 15s. The general trade demand has not improved, although it is expected that electrical works may, perhaps, be disposed to operate a little more freely; this, however, is naturally still governed by the outcome of the coal strike.

The future of lead is still very problematical.

Supplies still continue to arrive from Spain and Germany. The latter country may now send larger quantities, as the exchange is again in their favour, and will encourage them to make larger shipments to this country.

France now seems to be quite independent of this country; in fact, apparently they now have surplus lead to ship here, the exchange also being exceedingly favourable for them.

The outlook for the time being is, perhaps, a little brighter. We cannot, however, help thinking that lead is still too dear, and will eventually have to settle down on a lower level.

E.D.A. Activities.—A further indication of the activities of the Electrical Development Association is afforded by the receipt of another bunch of pamphlets from the society's headquarters. Following the usual lines, these publications deal with the domestic side of electricity, stress being laid upon the labour saving and cleanliness inseparable from its use. Lighting is dealt with in a booklet contrasting good and bad illumination, and giving copious notes on the way to obtain the best effects under various conditions, with hints for wiring. The Association has also issued an adhesive coloured label entitled "Electricity for Light and Life, Work and Play," which bears an attractive design. Another new print is a postcard, illustrating a thermometer, a fan and a radiator, which calls attention to the adaptability of electricity to the extremely changeable conditions of the English climate.

One of the great difficulties which had to be faced when the proposition to form a British Electrical Development Association took practical shape, consisted in the fact that the electricity supply industry in this country was mainly in the hands of municipal authorities, which were more or less tied. Financial support was, of course, indispensable, but the powers of municipalities in this respect were restricted; that obstacle was not incapable of circumvention, but a second, and, perhaps, greater difficulty lay in the necessity of convincing the members of the Committee in charge of an undertaking that it was in their interest to subscribe to the funds. We are glad to know that a letter has been circulated to the members of the I.M.E.A. by their Council, strongly urging them to support the Association, and testifying to the excellent work that has already been accomplished by "E.D.A."

Swedish Electrometallurgy.—The Swedish A.B. Elektrometall, which owns the patents of Gronwall, Lindblad, and Stalhane, for the electrical production of pig-iron, steel and other metals and alloys, and which also grants licences to work them, proposes to reduce the company's share capital by one-half, and repay the amount to the shareholders. The object is to prepare the company for the future in face of the fact that one-half of the period of patent protection has already expired.

The Italian Labour Crisis.—The Federation of Manufacturers on September 16th approved a resolution demanding the evacuation of the factories seized by the workmen, and compensation for damages, but accepting the principle of control as enforced by legislative enactments on condition, first, that it entails the co-operation and equal responsibility of the various parties concerned in production, and, secondly, that it is done in the interests of the community without encroaching upon the freedom of movement necessary to industry.—*Reuter* (Milan).

Winnipeg University.—Electrical Catalogues Wanted.—H.M. Trade Commissioner at Winnipeg, in a recent dispatch, reports that Prof. E. P. Fetherstonhaugh, B.Sc., Department of Electrical Engineering, University of Manitoba, Winnipeg, has promised to notify the Department of Overseas Trade of any additional apparatus that is required in connection with the equipment of the new laboratories of the University. The professor would be glad, in the meantime, if United Kingdom manufacturers of electrical instruments and apparatus would place his department on their mailing lists for catalogues and advertising matter.

Applications for British Trade-Marks.—Appended is a summary of the recent applications for British trade-marks in respect of goods connected with the electrical industries and trades:—

Rippla. No. 397,928. Class 6. Electrical machinery and parts. H. J. Handcock, 11, Victoria Street, S.W.; A. S. Brown, 7, Queen Square, Finsbury Avenue, E.C.; Chas. Oliver, Cambridge Place, Burrage Road, Woolwich; and A. H. Dyker, 11, Victoria Street, S.W. December 2nd, 1919.

The Dolphin. No. 401,576. Class 13. Electric lamps and fittings therefor. Philip Knowle, 27, Cannon Street, London, E.C. March 3rd, 1920.

Reliable Canadian Products (lettering combined with design). No. 393,696. Class 8. Electrical batteries and cells (not for medical purposes). Dominion Battery Co., Ltd., 736, Dundas Street East, Toronto, Canada. July 28th, 1919.

E. (letter combined with design). No. 405,008. Class 13. Electrical apparatus. George Ellison, Wellhead Lane Works, Perry Barr, Birmingham. June 9th, 1920.

Callophone (lettering in design form). No. 400,904. Class 8. Telephonic apparatus and accessories. The International Callophone Corporation, 151, Grand Street, New York. February 18th, 1920.

T.F.E.S. Co., Ltd. (lettering combined with design). No. 401,965. Class 18. Electric lighting apparatus. Fairless Engineering Supplies Co., Ltd., Station Works, Allison Street, Stockton-on-Tees. March 16th, 1920.

Thor. No. 404,026. Class 13. Electric lamps. Haslam and Stretton, Ltd., 11, Windsor Place, Cardiff. May 11th, 1920.

Wico. No. 402,380. Class 6. Magnetos and electrical machines. Witherbee Igniter Co., 132, Liberty Street, Springfield, Mass., U.S.A. March 13th, 1920.

S.C. (lettering combined with design). No. 398,715. Class 13. Sparking plugs. Jean Sender & Co., 11, Rue Chartran, Neuilly-sur-Seine, France. December 22nd, 1919.

Polar Cub. No. 391,717. Class 6. Electric fans, motors, generators, &c. The A. C. Gilbert Co., 119, Blatchley Avenue, New Haven, Conn., U.S.A. May 25th, 1919.

Aerex. No. 401,400. Class 9. Electric vacuum or suction apparatus for player pianos. H. W. Yeager & Co., 154, North 11th Street, Philadelphia, U.S.A. March 2nd, 1920.

Siemens (lettering combined with design). Nos. 398,633 and 398,634. Class 8. Dry cells. Siemens Bros. & Co., Ltd., Palace Place Mansions, Kensington Court, London, W. December 29th, 1919.

Peel. No. 405,494. Class 11. Electric switches. General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C. June 24th, 1920.

Vecolite. No. 402,031. Class 50. Insulating material. Ida Booth, 27, Fairfax Road, Bedford Park, London, W. March 18th, 1920.

Arcobio. No. 366,734. Class 4. Carbons for electric arc lamps. Gebrüder Siemens & Co., 128-137, Herzbergstrasse, Lichtenberg, Berlin. December 18th, 1914.

Arrota. No. 401,637. Class 13. Electrical and motor accessories. The Arrota Electrical and Motor Accessories Co., Ltd., Charles Street, Louth. March 9th, 1920.

Elfa (lettering combined with design). No. 404,713. Class 13. Electric torches and metal cases therefor. Arthur Kupper, 62, Noordestraat, Amsterdam, Holland. June 1st, 1920.

Paragon. No. 404,811. Class 13. Electric switches, fuses and cut-outs. The Midland Electric Manufacturing Co., Ltd., Stafford Works, Barford Street, Birmingham. May 3rd, 1920.

Shielda. No. 404,812. Class 13. Electric switches, fuses and cut-outs. The Midland Electric Manufacturing Co., Ltd., Stafford Works, Barford Street, Birmingham. May 3rd, 1920.

M.L. (lettering combined with design). No. 405,263. Class 6. Ignition apparatus for internal combustion engines. The M.L. Magneto Syndicate, Ltd., Victoria Works, West Orchard, Coventry. June 17th, 1920.

F.P. (lettering combined with design). No. 404,664. Class 13. Electrical goods. Ferguson, Pailin, Ltd., Edward Street, Higher Openshaw, Manchester. May 31st, 1920.

French Porcelain and Electrical Apparatus.—The shareholders in the Société des Porcelaines et Appareillages Electriques Grammont have sanctioned an increase in the share capital from 3,000,000 to 5,000,000 fr. and the issue of bonds as occasion may arise, for 5,000,000 fr., bearing interest at the rate of from 6 to 6½ per cent. It is explained that the capital augmentation is justified by the working of the Radiguet establishments, which comprise two works at Limoges and several quarries, and which were acquired a few months ago.

Trade with Turkey.—The *Board of Trade Journal* for September 16th contains a full review of the report of Capt. C. H. Courthope-Munroe, Commercial Secretary to the British High Commission at Constantinople, on the situation with regard to trade resumption in Turkey. American competition, the need for greater British enterprise in the market, methods of doing business, representation, pitfalls and precautionary measures for dealing with them, are discussed.

German Export Trade.—The Committee of the Foreign Trade Department for Electrical Engineering is forming a commerce and export trade group which, similarly to the technical trade group, will participate in discussions concerning the course of prices, especially with the object of meeting the complaints of merchants in connection with the present difficult situation. The Committee expresses the opinion that everything possible must be done to prevent a panic at the present time.

Contract Conditions.—A report of the Sydney (N.S.W.) Municipal Council states that with regard to the question of provision for variations in the amounts of contracts for plant in connection with the Council's electric lighting undertaking, and in connection with which the British Electrical and Allied Manufacturers' Association has addressed a letter, dated July 9th, 1920, provision will be made in future contracts, as follows:—

"In the event of any increase in the price of material occurring between the date of tender and the date of completion of the contract, the net amount of such increase shall be added to the contract price, a certificate from any recognised firm of auditors to be accepted as final in the event of any dispute as to the amount of such increase. For every shilling or pro rata increase in wages occurring between the said dates, 1 per cent. or pro rata, shall be added to the contract price, the latter increase being in the same proportion as the unexpired period of the contract is to the total period. In the event of completion of the work being delayed by causes beyond the reasonable control of the contractors, the contract period shall be extended accordingly, and any increase shall apply also to such extension, with the further condition that provision shall be made for reductions in the contract amount with decreases in the cost of material and labour, as well as for increases in the contract amount with increases in the cost of material and labour."

Australian Criticism of British Electrical Manufacturers. The *Melbourne Age* for July 26th contained the following:—

"Owing to the virtual suspension of the manufacture of electrical machinery during the war, manufacturers of this machinery all over the world are at present deluged with orders, whose date of fulfilment is a matter of great uncertainty. What will happen when the deluge passes away and production and orders become normal it is difficult to say, but the indications are that British manufacturers, who are reported to be treating their colonial customers with short-sighted indifference, will suffer. Though American manufacturers are also more than busy with orders, they are making special efforts to meet the needs of new customers, particularly those in Australia and other British Dominions, who have been looking to England for their supplies. Many items of electrical machinery had necessarily to be purchased from America during the war, and since the war the enormous differences in the quoted prices, which the very high rate of exchange has not been sufficient to compensate, have induced the continuance of trading relations with American manufacturers, whose future advantage they have not been slow to realise. Mr. J. H. Butters, general manager of the Tasmanian hydro-electric scheme, is going to England shortly, and will, it is stated, strive to bring home to British manufacturers of electrical machinery the extreme undesirability, from an Imperial point of view, of the continuance of the unfortunate state of affairs mentioned."

Patents and Designs Act, 1919. — Registration.— Attention is directed to Section 16 of the Patents and Designs Act, 1919, and especially to sub-section (4), which provides that a document or instrument in respect of which no entry has been made in the Register of Patents shall not be admitted in evidence in any court in proof of the title to a patent or to any interest therein unless the court otherwise directs.

Attention is also directed to the First Schedule of the Patents Rules, 1920, which provides that upon application for entry of name of subsequent proprietor or for entry of notices of a mortgage, licence or other document, in the Register of Patents, if made within six months from date of acquisition of proprietorship or interest, or the coming into force of the Rules, the fee payable in respect of one patent is £1. If such application be made after the six months period in question, the fee payable in respect of one patent is £10. Inasmuch as the Patents Rules, 1920, came into operation on April 1st last, it should be noted that in order to avoid the payment of the increased fee all such applications for registration in respect of dealings effected prior to that date should be received at the Patent Office, 25, Southampton Buildings, W.C. 2, not later than September 30th, 1920.

Copies of the Patents and Designs Act, 1919 (3d., by post 4½d.), and of the Patents Rules, 1920 (1s., by post 1s. 2d.), can be obtained from the Sale Branch of the Patent Office, 25, Southampton Buildings, London, W.C.2.—*B. of T. Journal.*

New French Companies.—There has been formed at Paris (8, Avenue Percier) the Energie Electrique du Tarn, with a capital of 1,000,000 fr.

Société d'Etudes de Chauffage Industriel is the style of a company formed at Nantes (76, Rue de la Bastille), with a capital of 500,000 fr., for the erection of heating systems, especially that by electricity.

For the working of the Moulin-Favre-Bulle electric clock patents the Compagnie Générale des Appareils Horo-Electriques has been constituted, with a capital of 1,200,000 fr. Its headquarters are at 17, Rue Gambetta, Boulogne-sur-Seine.

Porcelainerie d'Etampes is the title of a company launched at Paris (12, Rue Béranger) for the manufacture of electro-technical porcelain. Its capital is 400,000 fr.

A company styled the Mécanique Rotative, formed for the construction and working of every system of heat, water, and electric motors, and especially turbo-machines, has been established at Paris (8, Avenue Percier), with a capital of 2,000,000 fr.

The Approvisionnement Electrique Ultra (Reinbold, Lamblin et Cie) has been constituted a company at Saint Ouen (Seine) (3, Rue Morand), to carry out all operations related to electric tool equipment, machines, and metal founding. Its capital is 300,000 fr.

There has been formed at Lyons (60, Rue Chaponney) a company styled Etablissements H. Parmilleux, for the manufacture, sale, and repair of gas and electrical apparatus. Its capital is 500,000 fr.

La Précision Electrique is the name of a newly registered company, whose objects are the manufacture and sale of mechanical and electrical apparatus, instruments, &c. Its capital is 350,000 fr.; offices, 10, Rue Crocé-Spinelli, Paris.

With a capital of 200,000 fr. the Société d'Outillage Mécanique et Electrique has been formed, with offices at 48, Avenue La Bourdonnais, Paris. Its objects are the manufacture of mechanical and electrical equipment.

Having made a loss of 200,000 fr. on last year's working, the Electrique de l'Orléanais Company has decided to amalgamate with the Energie Industrielle.

After being authorised last month to raise the company's capital from 25,000,000 to 70,000,000 fr., the administration of the Electricité et Gaz du Nord have now been empowered to advance the capital to 100,000,000 fr.

The following companies have increased their capital: La Lumière Electrique (from 150,000 to 1,200,000 fr.); the Compagnie Générale de Telegraphie et de Telephonie (from 1,500,000 to 5,000,000 fr.); and Les Fabrications Electriques (from 800,000 to 1,100,000 fr.).

The Société de Fournitures Electriques has been registered a company at Strasburg, with a capital of 100,000 fr., to carry on the business of electrical suppliers.

Under the style of Société d'Electrification Omnia, Cautereau et Cie, a company has been formed at Paris (89, Rue de Flandre) with a capital of 250,000 fr., for the application of electricity to industrial and private requirements.

La Société de Matériel Electrique d'Asnieres has just been formed at Asnieres (39, Rue de Paris), with a capital of one million francs.

A new company has lately been formed in Paris (27, Rue Laffitte) with a capital of two million francs and the title La Société Electrotechnique de Metallurgie.

To work an electric lighting concession styled the "Secteur Electrique du Cours de la République," at Roanne, Messrs. Sainton and Noirot have formed a company, with a capital of 50,000 fr.

The Etablissements Bardon (Société de Construction Electrique et Mécanique) is the style of a company formed, with a capital of 1,000,000 fr. (raisable to 5,000,000 fr. by simple decision of the board), for the manufacture and sale of all kinds of electric and mechanical apparatus. Its offices are at 64, Boulevard National Clinchy (Seine).

With a capital of 800,000 fr. has been constituted a company styled the Manufacture Parisienne de Fils et Câbles Electriques (offices, 50, Rue Stendhal, Paris), for research into and manufacture of all kinds of electric conductors and their constituents.

Fiollet et Cie., with offices at 50, Rue de la Folie Regnault, Paris, have been constituted a company for the manufacture and sale of cables, electric wire, and insulating substances. Capital, 520,000 fr.

The Société des Forces Motrices du Rhône has raised its capital from 30,000,000 to 40,000,000 fr. by the issue to the shareholders of 20,000 500-fr. shares.

In order to enlarge its motor works, La Dauphinoise Electrique has raised its capital to 1,000,000 fr. The new capital was taken up by the shareholders.

The Etablissements Maljournal et Bourron have increased their capital from 3,000,000 to 8,000,000 fr.

For Sale.—Middleton (Lancs.) Corporation Electricity Department invites offers for one Lancashire boiler, 30 ft. by 8 ft., with fittings complete, one 300/400-kw. Belliss-Lancashire Dynamo Co.'s steam set, with switchgear and Korting's ejector. For full particulars, see our advertisement pages to-day.

Messrs. Leopold Farmer & Sons will sell by auction on October 12th, at 22, Cross Street, Islington, N.1, plant, machinery, and stock of the Betemal Engineers, Ltd., incorporating the Vaughan Engineering Co. (See our advertisement pages to-day.)

Harrow Electric Light and Power Co., Ltd., invites offers for three 60-kw. Willans-Crompton generating sets, one 180-kw. Willans-Siemens ditto, one Willans-Crompton steam balancer, four Babcock water-tube boilers, economiser, fan, &c. (See our advertisement pages to-day.)

Heckmondwike Urban District Council invites offers for one 75-kw. Reavell-Fowler generating set and one 75-kw. Fowler generator. See our advertisment pages to-day.

An Exhibition at Ghent.—*Reuter's Trade Service* reports that an international exhibition of architecture, building, and kindred industries is to be held at Ghent next year from April 16th to June 14th. The exhibition will include departments for architecture in general, building construction, cheap dwelling houses, hygienic installations, lighting and heating apparatus, electricity in all its applications, small tools, means of transport (motor and other vehicles), &c. Applications for space should be addressed, before the new year, to Monsieur A. Becker, 40, Rue Joseph Hazard, Uccle Bruxelles.

Plug Standards in Canada. — The Department of Overseas Trade informs us that a communication has been received from H.M. Trade Commissioner in Toronto (Mr. F. W. Field) in which he quotes the following report on standard plugs and receptacles, of the Regulations and Standards Committee of the Association of Municipal Electrical Utilities of Ontario. This was unanimously adopted by the delegates at the convention of the Association at Niagara Falls, Ontario, in June:—

"Your committee have endeavoured to secure information in view of adopting standard plugs and receptacles. The sale of appliances and satisfaction in the use of same by the public has been hindered owing to the confusion in existing plugs and receptacles. After careful consideration the committee report as follows:—

"Inasmuch as there is no standard practice covering the design of plugs and receptacles for permanent installations, and as there is a great need of having plugs and receptacles whose parts are interchangeable, be it resolved that this committee recommend and adopt the use of receptacles, plugs, and plug caps as follows:—

"1. Receptacles shall have parallel contacts suitable for both parallel and tandem caps.

"2. Plug bases shall have parallel contact or contacts suitable for both parallel and tandem caps.

"3. Caps shall have parallel contacts.

"4. Contact dimensions of caps shall be as follows: Outside, .560; inside, .436; width, .250; thickness, .062."

There are now in use in Ontario 12 different plugs made by the same number of manufacturers, all of which are interchangeable. It is likely that the managers of the municipal electrical enterprises throughout Ontario will specify those plugs when making purchases in future.

Social Events.—In 1917, in order to combat the serious shortage of foodstuffs due to the war, certain employés of the County of London Electric Supply Co., Ltd., diligently cultivated allotments, and at the end of the season conveyed certain of their produce to one of the local yards for inspection by their fellow workers. The movement "caught on," and in 1918 the company's staff formed the County of London Electric Supply Co.'s Allotments and Garden Society, headed by the engineer-in-chief, Mr. C. P. Sparks, as president. Members were enrolled to the number of 196, and an exhibition was held in a spacious marquee, beating all attempts of the previous year. In 1919, further great strides were made. The membership increased to 240. This year the position of the country's food supply having become easier, the society determined to cater also for those of the staff not interested in allotment work, and the name of the Society was changed to the "Horticultural and Social Society" under the presidentship of Sir Harry Renwick, K.B.E., deputy chairman of the company. A full season's cricket fixtures have been carried out, various concerts have been held with increasing attendances, and the membership has increased to 380. The fourth annual exhibition and garden party was held on Saturday, September 4th, in picturesque private grounds in Clapham Park, London, S.W. The exhibits of vegetables and flowers numbered 350, covering some 1,000 sq. ft. of table space, the display surpassing all previous records. Over 500 visitors attended, and music was rendered by the band of the 6th Battalion London Regiment. The prizes were presented by Lady Renwick. Mr. R. E. Ford, F.R.H.S., judged the exhibits, and stated that he had never seen a better arranged exhibition, and that the various exhibits were worthy of competition in any professional show.

The first annual sports meeting (under A.A.A. Rules) of Fuller's United Social and Athletic Association was held on Saturday, September 11th, in a meadow at Goodmayes. About 1,500 were present. The programme contained open, closed, and invitation events, and provision was made for the ladies and young people. Inter-departmental events were keenly contested, and caused great interest. Among the visiting competitors were teams from the Sterling Telephone Co., the Hart Accumulator Co., and the Roneo Co. (Romford). Prizes were distributed by Mrs. G. A. Fuller. Several of the directors, Messrs. G. A. and L. Fuller, and Mr. Gordon, were present.

The Demand for Electrical Goods in Chile. — The Commercial Secretary to H.M. Legation at Santiago (Mr. W. F. Vaughan Scott), in a recent report on the demand for electrical goods in Chile, states that Great Britain to-day seems to have absolutely no part in this trade, which, taking the market as a whole, must be very considerable when the number of electrical installations (over 200) in the country is taken into account.

He says that owing to the intermittent extreme cold periods experienced in most parts of Chile during the winter months, artificial heating is absolutely necessary, and on account of their convenience, electric stoves are becoming more and more popular. Nearly all the stoves sold in Chile (over 4,000) are of American manufacture. A certain number of stoves are made in the country and fitted up with American bulbs. The American stoves are generally quoted f.o.b., and in some few cases at port of shipment. No reliable information can be obtained regarding prices, as the same are constantly changing, but Mr. Scott gives in his report such information as he has been able to collect comparing British and American prices. He holds that there would be an opportunity for British manufacturers successfully to compete with all other makes if they could offer a cheaper, and as well-presented stove as the American, that would consume less current, as charges for energy are high in Santiago.

Electric Bulbs.—Of these, about 60 per cent. are of American manufacture, "the quality of which, from information obtained, is not very good"; 30 per cent. are Japanese, "which, in quality, are inferior to the American article"; and the balance of 10 per cent. correspond to those imported from other countries.

Electric Wire is principally imported from the United States of America, Japan, and Spain.

Electric Lamps, Fixtures, &c.—60 to 70 per cent. are imported, at present, from America, and the balance from other countries.

Battery Cells are mostly imported from the United States, and a certain amount from Spain.

A certain quantity of brass insulating tubing is being manufactured locally.

Aluminium Production in Germany.—Reports have been in circulation that the Lauta aluminium works near Hoyerswerda, belonging to the German Government, is in a difficult situation, as the cost of production substantially exceed prices abroad, and that orders are consequently lacking, stocks accumulating and workmen being discharged. It is, however, semi-officially stated that the reports in this form are incorrect. It is admitted that stocks are on hand as in other industries. The costs of production are such that the works could yield a favourable return on the capital in the present state of the world's markets and the rate of exchange. Quantities of 600 tons and 200 tons of crude aluminium have recently been sold for rolling elsewhere and for export by the purchaser. Under the auspices of the recently-appointed general manager, it has been found that the number of workmen employed has been disproportionate to the production, with the result that discharges have taken place. Not only so, but the generating station, which is based upon the use of lignite as fuel, has for some time past been transmitting power to distant places, and a supply will also shortly be furnished to Berlin, where a shortage of coal exists. The opinion is entertained by the manager that the future of the Lauta works is assured, unless the value of the mark undergoes a fundamental change.

The Use of Electricity in Holland.—According to Trade Notes forwarded to the Department of Overseas Trade by the Commercial Secretary to H.M. Legation at the Hague, in connection with the increased price of coal, the *Nieuwe Rotterdamsche Courant* states that it is urged that electricity be used to replace gas wherever possible. The power stations are producing 50 per cent. more electricity than last year, which was also an increase over 1918, in spite of rationing. The Hague and Amsterdam have set the example in making the change from gas to electricity by adapting the street gas lamps; other towns, however, have been slow to follow this course.

At the instance of the Coal Distribution Bureau, the Municipality of Rotterdam granted a credit of 40,000 florins to electrify 800 street lanterns; but, unless constant pressure is exerted, no further steps will be taken in this direction.

In view of the coal scarcity, industry generally is advised to spare the use of gas and to extend that of electricity.

Electrical Machinery for Tasmania.—Mr. J. H. Butters, general manager of the State Hydro-Electric Department, who left on August 2nd for Canada, the United States, and England, is studying the latest developments affecting hydro-electricity, and will select machinery for the big construction works now in progress in Tasmania. Mr. Butters will also investigate the working of some of the important power, water supply, and irrigation organisations in Canada and the United States, with a view to recommending the system most suitable for Tasmania. He will be absent seven or eight months.

Speaking at a function early in August, Mr. Butters said that when the Great Lake scheme was completed, they would be generating 78,000 H.P. Other schemes would then be initiated. A water-power survey of Tasmanian resources was in progress. Those controlling the department had in mind a scheme under which it would be possible ultimately to generate up to 200,000 H.P. He also stated the department had done its share in connection with providing for the requirements of the big electrolytic work at Risdon.—*Reuter's Trade Service.*

D.K. Lady Footballers.—The forthcoming tour of MESSRS. DICK, KERR'S ladies football team in France, where they will play four matches, is to receive the patronage of Lord Derby, the British Ambassador, who has associated his name with the undertaking, as have also the directors of the English Electric Co., including Sir Charles Ellis, K.C.B. (chairman), Mr. W. L. Hichens (deputy chairman), Lord Meston, K.C.S.I., Sir John Aspinall, Sir Alex. Gracie, Lieut-Col. Sir John Mansell, D.L., and the officials of the firm. It is hoped to arrange a match in London on the return journey on November 9th. The team has raised £8,340 for charities.

Saturday Work in Australia.—The Compulsory Conference which was called by the State Labour Government to settle the question of Saturday work, has resulted in a settlement under which the Unions have agreed to revert to the normal working week. The dispute originally arose in consequence of the refusal of the boilermakers and engineers to work on Saturday to enforce their demand for a 44-hour week.—*Reuter.*

The Engineering Dispute.—When the Court of Inquiry met on Thursday last week, Sir Allan Smith drew the chairman's attention to the recommendations of the National Joint Industrial Council (reported in our last issue), and suggested that the Court should adjourn to enable the parties to consider the position. Mr. Rowan supported the suggestion, and the chairman adopted it. On the following morning Sir Allan read an agreement which had been arrived at, and urged that the Court should not proceed further with the inquiry. Mr. Rowan endorsed this view, and the chairman, expressing satisfaction with the position, adjourned the Court *sine die*.

The following are the terms of agreement:—

EMPLOYMENT OF FOREMEN.

As the Electrical Trades Union do not demand that foremen must be members of a Trade Union—

It is mutually agreed:—

1. The men on strike shall resume work.
2. The notices issued by the federated firms shall be cancelled.
3. A general resumption of work shall take place as soon as possible according to the circumstances prevailing at each works.
4. No victimisation shall take place on either side.

The Court of Inquiry eventually resumed its sittings, and will report to the Minister of Labour.

Before the dispute was settled the Metropolitan Electric Tramways Co. and the London United Electric Tramways gave notice that in the event of an electricians' strike they would have to dispense with the services of all their employés during the strike.

At a meeting of the National Joint Board held on September 18th, the representatives of the Electrical Power Engineers' Association explained that their attitude with regard to the recent dispute in the engineering industry and its threatened extension to the electricity supply industry was dictated by a desire to support regularly-constituted machinery for the settlement of disputes.

The declared intention of the E.P.E.A. to adhere to constitutional methods received the full approval of the employers' representatives on the National Joint Board, who took the opportunity of emphasising the value of the Board as a means of conciliation, and of urging all electricity supply undertakings to support the Board's work by a prompt and loyal acceptance of its recommendations.

Book Notices.—We have received from the London School of Economics and Political Science a copy of the Calendar of the School for the 1920-21 Session (2s. 6d. net). Important developments have taken place in the School recently, in respect of higher teaching in commercial subjects and the institution of a Commerce Degree, and an extensive programme of lectures and classes on such subjects, for day and evening students, has been prepared. Full particulars of these are conveniently arranged for reference, and information is given of the degrees, diplomas and certificates which are obtainable.

"The Output Problem." By J. E. Powell. Pp. vii + 168. London: The Library Press, Ltd. Price 6s. net.

"Tramway Motorman's Handbook." By W. S. Ibbetson. Pp. viii + 208; 47 figs. London: E. & F. N. Spon. Price 6s. 6d. net.

"The Henley Telegraph," September, 1920 (32 pp.).—The present number of the house magazine of Messrs. W. T. Henley's Telegraph Works Co., Ltd., is produced in its usual brightly-written style, containing articles of general interest showing excellent literary taste.

"The Metropolitan-Vickers Gazette," No. 89, August, 1920 (18 pp.).—This number of the "Gazette" includes an interesting and well-illustrated article on the London and South-Western Railway electrification and notes on a test on a large oil circuit-breaker. There is also a description of Messrs. Rudge-Whitworth, Ltd.'s, ball-bearing factory at Birmingham.

"*Journal* of the Institution of Electrical Engineers." Vol. LXIII. No. 293. July, 1920. London: F. & N. Spon, Ltd. Price 10s. 6d. —This issue contains the following papers:—"Automatic Protective Devices for Alternating-current Systems," by A. E. McColl; "Duplex Wireless Telephony: Some Experiments on its Application to Aircraft," by Captain P. P. Eckersley; "Modern Marine Problems in War and Peace" (eleventh Kelvin Lecture), by Dr. C. V. Drysdale; also the Chairman's (Prof. E. W. Marchant) address to the Liverpool Sub-Centre, and the Report and Accounts of the Benevolent Fund for 1919.

"*Transactions* of the Faraday Society." Vol. XV. Part 3. June, 1920. London: The Society. Price 17s. 6d.

"Vickers News." Vol. II, No. 23 (14 pp.).—The September number of this interesting journal includes articles on the "Contrafio" auxiliary condenser, the association of high elastic limit and toughness in steel, and a description of Messrs. W. T. Glover and Co.'s cable works at Trafford Park, Manchester.

The British Industries Fair.—We have received from the Department of Overseas Trade a copy of a booklet in English on the forthcoming British Industries Fair to be held in London (at the "White City"), and in Glasgow and Birmingham, between February 21st and March 4th, 1921. This booklet is about to be distributed overseas, and it will be printed in seven different languages. The issue forms part of the scheme for propaganda overseas to attract foreign buyers and those from the Dominions and Colonies to come to the next fair.

Electrical Manufacturing in Australia.—A new company is being formed under the title of the Commonwealth Electric and Metal Co. with a capital of £500,000, to establish works at Newcastle for the purpose of producing electrical equipment, metallic alloys, and various other metal manufactures.—*Reuter's Trade Service* (Melbourne).

Electricity Supply Rifle League.—A very successful Prize Meeting was held under the auspices of the League on September 11th on the ranges of the Hackney Electric Rifle Club. There were between 30 and 40 competitors for the various events, and as the weather was extremely favourable, shooting took place under ideal conditions. Owing to holidays, there was not such a large attendance as was anticipated, but next year it is hoped to have the meeting earlier, when many more will be able to attend. The captain of the Metropolitan Co., Mr. H. J. Taylor, had the best aggregate for shooting at 25 yds. (deliberate and rapid), 50 yds. and 75 yds. The arrangements for the meeting were carried out by the members of the Hackney club, who were second in the team shoot. The secretary of the League, Mr. E. Matthews, assisted by Mr. Howe, of the City of London Club, and Mr. Atkins, captain of the Hackney Club, acted as officials. The following were the winners of the various events:—25 yds. scratch.—W. Hutchings (98), Metropolitan Electric; Pool.—H. J. Taylor (100), Metropolitan; Handicap.—A. Ridd (99), Shoreditch; Rapid.—A. Barbour (95), Shoreditch; Pool.—H. J. Taylor (99), Metropolitan; Team.—Shoreditch A (291); 50 yds. scratch.—P. C. Ebner (100), Shoreditch; Handicap —A. Pitcher (98·4), Shoreditch; Pool.—E. A. Foster (97), Shoreditch; 75 yds. scratch.—A. Pitcher (99), Shoreditch; Pool.—H. J. Taylor (98), Metropolitan; Championship.—H. J. Taylor, Metropolitan.

Erith-Riley Stokers.—Amongst recent orders for Erith-Riley stokers are 19 of the size ordered for Edinburgh, namely:—

Fourth repeat order, Calcutta E.S. Corporation	...	3	stokers
First order, Union d'Electrique, Paris	... ...	4	"
Repeat order " "	... ...	4	"
Cie. Parisienne de Distribution Electrique...	...	8	"

Each stoker is suited for a boiler raising 80,000 lb. of steam per hour. MESSRS. ERITH'S ENGINEERING CO., LTD., are now furnishing also, to the order of Messrs. Preece, Cardew & Rider, six Erith-Riley stokers, each 20 per cent. larger than the above, for six boilers each raising 92,000 lb. of steam per hour, with low-grade fine slack coal. Whatever the make and size of boiler, a single Erith-Riley self-cleaning stoker suffices, as these stokers are assembled from any number of uniform, standardised, self-cleaning, underfeed retort units.

Norwegian Statistics.—According to statistics which have only now been published in Norway, the number of glow lamps installed in the country at the beginning of 1918 was 2,714,574, as compared with 2,282,693 in 1917, and 1,965,440 at the commencement of 1916; and that of arc lamps was 2,815, 3,132 and 3,603 in the same years respectively. The plant used for lighting at the opening of 1918 represented 104,252 KW., or one-tenth of the total plant in use.

No Tenders for Spanish Railway.—No result was obtained in connection with the second adjudication for the construction of the direct line from Madrid to Valencia at a cost of 145,400,000 pesetas, as tenders were not forthcoming.—*Reuter's Trade Service* (Madrid).

Sweden.—A new company has been formed at Gaevle, by MM. Gunnar Sanzelius and Samuel Berg, of Stockholm, M. Joh. Parsson, of Gaevle, and others, with the object of manufacturing electrical installations, machinery and fittings. It will be known as Aktiebolaget Elektriska Ledningsfabriken, and its minimum capital of Kr. 200,000 will be divided into shares of Kr. 200 each.

AKTIEBOLAGET ELEKTROMETALL, which holds a patent for the manufacture by an electrical procedure of pig-iron, steel and other metals, has decided to reduce its share capital to half of the present 441,000 kr. by repayment to shareholders of half the capital invested.—*Reuter's Trade Service* (Stockholm).

Electrical Developments in Rumania.—The Omnium Electrique Roumain has been formed at Bucharest by a banking group, headed by the Banque Marmarosh, Blank et Compagnie, to develop the use of electricity in Rumania, the share capital being 20,000,000 lei.

Australian Iron and Steel Works.—The Premier of Queensland has announced that the Federal Government will not abandon the plans for the State iron and steel works, even if the response to the local loan is unsatisfactory. Engineering firms of repute in England have sounded the Government as regards supplying and erecting the necessary machinery and financing the whole project.—*Reuter's Trade Service* (Brisbane).

Water Turbines for Russia.—According to an announcement in the *Kölnische Zeitung*, Prof. Lomonosow, Chief of the Russian Transport Department, who is in Berlin, states that three hydro-electric power stations have been started in Russia, but progress has been held up through the absence of water turbines.—*Board of Trade Journal*.

Labour in Australia.—At a meeting in Sydney of engineers and ironworkers demanding a 44-hour week, Mr. Garden, the secretary of the Labour Council, advised the men to take control of the workshops if the employers refused to concede their demands. The proposal was rejected by the Union secretary, who stated that that was not the time for foreign propaganda.—*Daily Telegraph*.

Catalogues Wanted. — MR. H. HODGKINS, factor, of 486, London Road, Westcliff-on-Sea, desires to receive price-lists from manufacturers of accessories, cable, &c., and to take up new agencies.

Mica.—The Ridge Roasting Furnace and Engineering Co. report that mica shipments from South Africa have been resumed, and a first parcel has just arrived per s.s. *Nevasa*, while other shipments have been advised by cable. Considerable quantities are expected at regular intervals.

Wire Manufacturing in Australia.—The Postmaster-General's Department, which is anxious to see the manufacture of galvanised iron wire established in Australia, is prepared to order immediately 350 tons of such wire of various gauges at attractive prices.—*Reuter's Trade Service* (Melbourne).

German Dry Batteries.—A correspondent writes drawing attention to the export trade-getting methods of a German manufacturer of dry batteries. While no attempt is made in correspondence to conceal the fact that the house from which it emanates is German, the batteries themselves when received bear a label with an inscription in French, from which the user or purchaser may be given a false impression that the battery is French-made. This is a low-down trick, but it is little more than we have learned to expect from such a quarter. We pass the warning on to traders who want to keep their hands clean.

A Ford "University."—The *Electrical World* states that the Ford Motor Co. has established an educational department to be known as the Ford Technical Institute. This institute will occupy the status of a university, with power to grant degrees in mechanical, electrical, and chemical engineering.

The Samples Fair at Prague.—An International Autumn Fair is being held at Prague this month. It closes on September 28th.

Fire.—A fire in the compressor room at the Vulcan Works, Thornton Road, Bradford (Thwaites Bros., engineers), did a good deal of damage to the electrical equipment.

American Bosch Developments.—The American Bosch Magneto Corporation has acquired control of the Gray and Davis Co., manufacturers of starting, lighting, battery ignition systems, Boston. The combined capital of the two concerns is estimated at $15,000,000.—*Reuter's Trade Service* (Springfield, Mass.).

LIGHTING AND POWER NOTES.

Accrington.—Suspension of Supply. — Through a mishap to cables, the electricity supply to part of Accrington was cut off for three hours on September 15th. Several works dependent for their motive power upon electricity had to suspend operations.

Annfield Plain (Co. Durham).—New Undertaking.—The electricity undertaking was officially opened on September 17th. Last year the Urban District Council negotiated, and obtained by mutual consent, the transfer of the Provisional Order from the Newcastle-upon-Tyne Electric Supply Co., Ltd. A scheme was then drawn up for purchasing a bulk supply from the Newcastle Electric Supply Co., at 2,750 volts, three-phase, 40 periods, and serving three sub-stations, where the pressure would be reduced to 440 volts, three-phase, for power, and 250-volts, single-phase, for lighting. There is approximately 15 miles' route-length of overhead distributors for the purpose of supplying private consumers, and about 500 lamps for public street lighting. The low-pressure pole-line work was carried out by Messrs. Cox-Walkers, Ltd., of Darlington. The consulting engineer for the whole scheme was Mr. T. Dawson Martin, A.M.I.E.E., of Newcastle-upon-Tyne.

Australia.—Osborne (South Australia).—Substantial progress has been made with the building of the new power house for the Adelaide Electric Supply Co., on the site acquired last year at Osborne, on the Port River, near the Outer Harbour. In order to carry the heavy weights of the generating plant the whole of the site has been piled. Orders have been placed with the Metropolitan-Vickers Co., of England, for one 10,000-kw. (13,200 h.p.) and one 5,000-kw. (6,600 h.p.) turbo-generators. Another 5,000-kw. turbo-generator is also now being shipped, and will be temporarily erected at the Grenfell Street power house and removed to Osborne later.—*British Australasian.*

Sydney (N.S.W.).—The Municipal Council proposes that, with regard to a report by the city electrical engineer, about the advisability of encouraging the manufacture of electrical apparatus in Australia, and a request by the Commissioners for Railways for a conference with the city electrical engineer with a view to selecting the size and type of equipment that would be most advantageous to manufacture, in view of the Council being the only other user of electrical plant that is likely to require generating units of output equal to those of the Railway Commissioners, the chief electrical engineer be authorised to confer with the chief electrical engineer to the Railway Department on this subject.

Barnsley.—Mains Extensions.—At the Town Council meeting last week, the Electricity and Lighting Committee recommended that application be made for power to borrow £14,200 for laying mains and services and other purposes, as follows:—Excess expenditure on mains, services, sub-stations and high-tension switchgear, to March 31st, 1920, £7,560; mains, services, high-tension switchgear in sub-stations, £6,640. The Committee also recommended the extension of the main from Messrs. Gillott's sub-station to the sanitary department at Pegmoor, at an estimated cost of £1,085. They also recommended approval of an application from the British Co-operative Society, Ltd., for a bulk supply of energy for its central stores, wholesale department, and flour mill.

Barrow-in-Furness.—Price Increase. — At a special meeting of the Town Council, the pre-war charge of 4½d. per unit for electricity supplied for lighting was raised to 8d., the statutory maximum. The price of electricity for other purposes was also increased by the addition of sums varying from 33 to 116 per cent. above the pre-war rates.

Bodmin.—Public Lighting.—The Town Council has accepted the tender of the Electric Light Co., which offered to carry out public lighting at a charge of £278 per annum. The Gas Co.'s tender amounted to £296.

Burnley.—Year's Working.—The report on the electricity undertaking for the year ended March 31st last records a total revenue of £60,800, as compared with £43,275 for the previous period. Working expenses amounted to £40,559, against £27,269 for 1918-19, leaving a gross profit of £20,241 (£16,006). The net profit, after payment of capital charges, was £5,718, an increase of £4,228 on the profit for the previous year. The total number of units sold rose from 5,728,371 to 7,113,310. The cost per unit increased from 1·750d. to 1·858d.

Bury St. Edmund's.—Condensing Plant.—At a recent meeting the Town Council approved of the purchase of a surface condenser from the Glasgow Corporation, at a price of £500. The condenser house is to be extended to house this plant.

Carlisle.—Year's Working.—The annual report for the year ended March 31st last shows that the total revenue of the electricity department was £48,980, compared with £39,378 for 1918-19. Working costs amounted to £33,252, against £27,211, leaving a gross profit of £15,728, an increase of £3,561 upon the previous year's figure. The net result, after payment of capital charges, was a credit balance of £2,301, a satisfactory increase upon last year's net profit—£923. The number of units sold rose from 5,560,321 to 6,216,678, and the average price obtained from 1·70d. to 1·89d.

Ceylon.—Water-Power Development. — When the war broke out, the Public Works Department was engaged in surveying the water-power facilities in Ceylon. That work was put an end to by the war, but it has now been taken up again. Hitherto, and in the East generally, the standard American frequency of 60 cycles has been largely adopted, but Mr. Meares, the electrical adviser to the Indian Government, who has been loaned to the Ceylon Government, recommends the British standard frequency of 50 cycles, and in his report, expresses the conviction that the consulting engineers will be able to place the order for the electrical machinery required within the British Empire.—*American Commerce Reports.*

China.—Pekin Electricity Supply. — The Peking Electric Light and Power Co. is contemplating the erection of a new power station, and the laying of additional mains. The local papers have recently urged that the company's monopoly concession should not be renewed when it expires, owing to the unsatisfactory supply that is being given, and a demand is being made that competition should be allowed. The proposal to erect a new power station is an endeavour to deal with the situation.—*American Commerce Reports.*

Continental.—Switzerland. — The *Board of Trade Journal* states that an estimate compiled by the Swiss Hydro-Economic Union, places the total output of Swiss power-stations for lighting and general purposes at from 1·2 to 1·3 milliard kw.-hours, or, roughly, 300 kw.-hours per inhabitant per year. The war gave a great impetus to the consumption of electricity, and during the years 1915-17 the outputs of the North-East, the Berne and the Basle power works increased by 50, 58 and 42 per cent. respectively. Among the large stations recently built, are the new stations built on the Aare, near Alten-Goesgen, by the society "Motor." These have a capacity of 50,000 h.p., and the power station of Eglisau, nearly finished by the North-East Swiss Power Works, which will have an output equivalent to 32,000 h.p. The Swiss Federal Railways have three stations under construction—Ritom, Barbarine and Amsteg—designed to supply the power for railway electrification. The preliminary work has been started at the big station on the Joigne, at Rossens, which will have a total power of 60,000 h.p. Two companies which aim to effect co-operation between existing undertakings have been formed, these are the Société Anonyme d'Energie de l'Ouest Suisse and the Kraftubertragung für vermittelung und Verwertung von Elektricitat. The latter proposes to erect a high-pressure line right across the country from the Lake of Geneva to Lake Constance. The former company will construct a line running from Rossens, *via* Lausanne, to Geneva, and another running north through the Jura to Basle. The Swiss Hydro-Economic Union considers that the water-power resources of Switzerland are sufficient for the entire electrification of the country, and will give a surplus for export, &c.

France.—A Law was published in the *Journal Officiel* of August 19th, providing for the construction of the works necessary for a high-pressure electrical power system in the liberated areas. The scheme provides for the construction of stations at Pont-à-Vendin, Douai, Valenciennes, Nœux, Bully-Grenay, Lille, Cambrai,

Jeumont, Beautor, Laon, Reims, Epernay, Mohon, Stenay, Verdun, Saint-Dizier, Longwy, Piennes, Briey, Nancey, Vincey, Fontoy, la Houve, Bischborn, Chambray, Paris, Saint-Just, Arras. The chief generating station will be at Hirson, on the Aisne. The cost is estimated for the present at 135,000,000 fr., and will be subscribed partly by the State.—*B. of T. Journal.*

The members of the Senate for the departments of Puy de-Dôme, Cantal, Corrèze, Lot-et-Garonne, Gironde, Haute Vienne, Charente, and Dordogne had a meeting recently at the Senate House, with a view of finding means to secure the development of the water-courses in the Dordogne basin on lines similar to those proposed in the case of the Rhône. The Conseils Généraux is to be asked to sanction the appointment of an interdepartmental commission to draft the plans for the scheme.

Spain.—La Sociedad Energia Electrica del Centro de Espana has recently secured a concession to establish a plant to utilise the water power of the River Alto Guadiana, at Ossa de Montiel (Province of Ciudad Real), for the generation of electrical energy.

Norway.—Work in connection with the Aura power station was begun in April, 1914. Many difficulties were encountered during the years of war, and working was finally stopped, but is now to be resumed. It was originally estimated that the whole of the Aura works would involve an expenditure of 38,000,000 kroner. The idea was first to utilise the Lilledal water course so as to obtain 90,000 H.P. by the end of 1921, and to increase this power to 300,000 H.P. by the further use of the Aura River. So far, however, only one-third of the whole works has been put in hand, and this has absorbed 20,000,000 kroner. The first instalment, which is to yield 44,000 H.P., is not yet completed, and additional capital is required for the purpose. In the case of the Ranasfoss, the work is progressing rapidly, and is expected to be finished next autumn. This fall is to yield 72,000 H.P.; a sum of 15,000,000 kroner has already been expended on the undertaking, which is to be completed at a cost of 41,000,000 kroner, as contrasted with the original estimate of 18,000,000 kroner.

Germany.—According to the *Berliner Tagsblatt*, very far-reaching developments are contemplated by the Rheinisch-Westfälische Elektrizitätswerke, which already supplies a large part of the Rhenish-Westphalian industrial area with electricity. The plan provides for extension in two directions. On the one hand, the company proposes to extend the area which it supplies by combination with other generating works in the industrial area, and especially with the Elektrizitätswerke Westfälen Aktien-Gesellschaft, with the avowed object of ultimately bringing the electrical supply of the entire Rhur basin under one control. Even more interesting developments in the other direction have as their object the changing of the main fuel basis of the whole concern from coal to lignite. This object is to be attained through the working agreement which has been come to with the Braunkohlenwerk Roddergrube. This agreement provides for the complete taking over of the Roddergrube concern at a later date—*Reuter's Trade Service* (Berlin).

Czecho-Slovakia.—According to *Narodni Politika*, the Czecho-Slovak Government is working out an extensive electrification scheme, providing for damming arrangements and electricity works in the chief rivers of Bohemia, Moravia, Silesia, and Slovakia. All the important coal mines are to be electrified.—*Economic Review.*

Italy.—The Italian Government has already granted concessions for the exploitation of water power of more than 2 million H.P., of which 1·5 million H.P. has already been harnessed. The fact that the concessions have not been utilised to their full extent is attributable to the high cost of building and the lack of material. Italy's requirements in electric energy are, however, very large. Thus, 500,000 H.P. would be required for the manufacture of nitrogenous fertilisers, and 4 million H.P. for the running of blast furnaces and the working up of spelter. Requirements will be further increased by the electrification of the railways; the project already sanctioned provides for the electrification of 4,000 km. The electrification of the entire system would result in the saving of 1·8 million tons of coal annually, which is equivalent to 800 or 900 million lire.—*Economic Review.*

Donegal.—Request for Electric Light.—At the last meeting of the Urban Council, a deputation of residents urged on the Council the desirability of improving the water supply of the town and the changing of the gas lighting into electrical lighting. The Council said that it was proposed to continue gas lighting till a company was formed for electrically lighting the town.

Dundee.—Housing Scheme.—The Corporation has erected centrally-heated houses which possess a 24-hours hot water supply; electricity is also installed, for a certain quantity of which 6d. per week is charged.

Fort William.—Water-Power Scheme.—There is every prospect, it is stated, that the great water power of Lochaber will be utilised for the production of electricity, which will be used for the manufacture of aluminium, the central works to be at Fort William.

Guildford.—Sale of Undertaking.—The shareholders of the Electricity Supply Co., Ltd., have agreed to sell the undertaking to the Corporation for not less than £55,000.

Hunsworth (Yorks).—Electric Light Experiment.—At a meeting of the Urban District Council last week, Mr. J. J. Blackburn, a member of the Council, speaking of the high cost of the present system of gas lighting for the streets, proposed electric lighting at Lower Hunsworth as an experiment, and submitted an offer from the Yorkshire Electric Power Co. to light Whitehall Road and part of Hunsworth Lane for £130 per year, the company being responsible for maintenance and renewals. Mr. Blackburn pointed out that gas lamp renewals needed would cost £100, quite apart from the cost of light. Councillor Verity supported Mr. Blackburn, and hoped such an experiment would be extended to the remainder of the district. The Council appointed a sub-committee to inquire into the matter.

Leadgate.—Electric Lighting.—The Urban District Council has received a draft agreement from the Consett Iron Co., which has agreed to supply the necessary electricity for lighting the district.

London.—Fulham.—It was reported at a meeting of the Borough Council that the unclaimed balances of electric light deposits which had accumulated since the commencement of the undertaking to March 31st last amounted to £560 8s. 11d. £500 of this sum had been transferred to the Rent Commutation Investment account.

Nottingham.—Commissioners' Decision.—Ruling that the erection of a new generating station on the Trent by the Derbyshire, Notts. Electric Power Co. would be an encroachment upon the City Corporation's rights of supply, the Electricity Commissioners have refused to sanction the scheme, and have approved the erection of a station by the Corporation, subject to the following conditions:—(1) The plans and general lay-out of the station must be approved by the Commissioners; (2) the Corporation shall, if required by the company, supply to it such high-tension energy in bulk as the company may require, on terms to be agreed, or failing agreement, to be settled by the Commissioners; (3) if a joint electricity authority is set up for the district, under the Electricity Supply Act of last year, the Corporation shall, if required by that authority, and if directed by the Commissioners, transfer the station to the joint authority, the Corporation being reimbursed on certain terms.

Oldham.—Year's Working.—The abstract of the electricity department accounts for the year ended March 25th last records a total revenue from all sources of £119,124, against £88,405 in the previous year. The total of working expenses was £69,976, against £56,408, leaving a gross profit of £49,148 (£32,497). The net result, after payment of capital charges, was a credit balance of £10,774, an increase of £2,448 on the previous year's profit. The number of units generated rose from 18,550,564 to 21,011,346. The plant capacity is now 10,680 KW.

Risca.—Provisional Order.—The Urban District Council is applying to the Electricity Commissioners for powers to generate and supply electricity for public and private purposes.

U.S.A.—California.—The Mount Shasta Power Co., a corporation owned by the Pacific Gas and Electric Co., has applied to the State Railroad Commission for authority to make expenditures aggregating $125,000,000 for the development of hydro-electric power. The plan of the company is to install a plant with 515,000 H.P. at one point in the mountains, and to conserve the streams in other areas to develop 7,000,000 KW.-hours a day. This will virtually double the power output of the plants operated by the Pacific Gas and Electric Co. The use of hydro-electric power will save this corporation 35,000 barrels of oil a day. Five new power houses are to be constructed, and a 7-mile concrete tunnel will have to be built.—*Reuter's Trade Service* (San Francisco).

TRAMWAY AND RAILWAY NOTES.

Australia.—Toowoomba, Victoria.—In his report on the proposed electric tramway and general power requirements for Toowoomba, Mr. F. A. M'Carty, A.I.E.E., consulting engineer, of Melbourne, shows that the cost of the undertaking would be:—For tramway purposes only: Tramway, £143,752; power station, £32,500; total, £176,252. The cost of the power station scheme, covering the demands of the tramway, pump motors and street lighting, £39,500; for tramway and power for present and future requirements, £62,400. The report shows that the total single track mileage of the route proposed would be:—Ordinary construction, 7·6 miles; special construction, 2·1 miles. The gauge would be the recognised standard of 4 ft. 8½ in., and the car it is proposed to use would be about 28 ft. over all, 8 ft. wide, and would seat about 32 passengers.—*Reuter's Trade Service* (Melbourne).

Bradford.—Fare Increase.—The City Council, last week, approved an increase of tramway fares to figures which, roughly—and without affecting school-children—amount to double the pre-war fares. Opposition in the Council was modified by the fact that the undertaking was losing, on existing conditions, at the rate of about £1,000 per week, and by the heavy expenditure in relaying the permanent way, which Alderman Palin (deputy-chairman of the Committee) said was now costing £30,000 per mile, instead of £10,000 per mile pre-war cost.

British Railways.—Electric Trains.—The *Railway Gazette* recently published, among many other statistics, a table showing the increase or decrease in the number of vehicles in electric trains on the various British railways. The figures given are as follows:—Great Western, 1913—60, 1919—60; London and

North-Western, 1913—none, 1919—131; Midland, 1913—117, 1919—118; London and South-Western, 1913—29, 1919—283; Great Central, 1913—12, 1919—16; North-Eastern, 1913—110, 1919—91; Lancashire and Yorkshire, 1913—159, 1919—220; London, Brighton and South Coast, 1913—132; 1919—144. These figures show totals of 619 in 1913, and 1,063 in 1919, an increase of 444, or 71·73 per cent.

Continental.—ITALY.—The longest electric tramway in Italy is that from Marostica to Asiago, lately opened for traffic, which is 40 km. in length. The line starts from Marostica, and passes through Vallonara, Crosara, Conco, the Osteria di Puffale to its destination, by an extremely tortuous track. The generating plant is situated at Marostica, and the line is sectioned, with appropriate interrupters at every 5 km.

As a result of the constant demands for higher wages and the troubles in the matter of coal and exchange questions, various tramway undertakings which were formerly established by Belgian interests in Italian towns seem to have got into a difficult situation, particularly in Bologna, Catania, Florence, Leghorn, Milan, Bergamo, Palermo, Turin, and Verona. Some of the tramways are no longer able to pay interest on the loans which were raised, mostly in Belgium. As a consequence, the Belgian-owned undertakings have combined in a group, and have forwarded, through the intermediary of the Belgian Legation, a note to the Italian Ministry for Foreign Affairs, suggesting that the Italian Government, or the local authorities concerned, should take over the tramways in question.

The tramway cars and depôts at Rome have been seized, as have also a large number of factories and other industrial undertakings in different parts of the country, by the workers, who have displaced the managements, and are attempting to run the undertakings themselves.

GERMANY.—Coal as a power producer will be replaced so far as possible by the use of peat in the electrification of railroads in the vicinity of the large German cities. Great hopes are being placed on the new Theissen 10,000-H.P. vertical gas turbine, two of which have been ordered for use on the German railways. It is hoped that they will be able to replace the coal-burning locomotives.

The peat bogs at Osnabruck will furnish the fuel. Machinery for the working of this peat has been installed, and it was expected that the first deliveries will take place by September 1st. Experiments are being made by the German Government with machinery for pressing the peat so that it may be transported economically.—*Electric Traction.*

SWEDEN.—Mr. Esinar Magnussen, traffic manager of the Stockholm tramways, raised the question of a uniform or a zone tariff at the annual Conference of the Swedish Tramways Association, which was held recently in Stockholm. The author stated that the advantages of the uniform tariff were so obvious that no controversy should arise on the question. It should also be recognised that a uniform tariff was of great importance in connection with the housing problem, as it facilitated residence in the suburbs, and also permitted economically weaker persons to remove to the outskirts in cheaper, more airy and more healthy surroundings. As to the amount of the uniform fare, the author mentioned that the number of passengers in Stockholm had declined since the last increase in fares from 15 to 20 ore took place. Down to the present time the decrease had amounted to 8 per cent., notwithstanding that a year had elapsed since the advance was made. The conclusion to be drawn from this circumstance was that it was necessary to proceed very cautiously so long as large portions of the population had not received full compensation for the fall in the value of money. If, then, the situation, as in Stockholm, was such that income and expenses did not balance, the question arose as to what measures should be adopted if the zone tariff was not applicable, and it was impossible to raise the uniform fares to a sufficient extent. The answer, the author concluded, was to reduce the expenses for labour, but experts differed as to the most suitable manner for effecting a reduction.

Huddersfield.—FARE INCREASE.—The Corporation recently advanced passenger fares and charges for goods conveyance on the tramways. In response to representations by the Chamber of Trade, the department has agreed to allow passengers to convey up to 28 lb. of luggage or merchandise free of charge.

India.—BANGALORE TRAMWAYS.—A scheme for the construction of electric tramways in Bangalore was worked out and an estimate for the work amounting to Rs. 6,75,530 was sanctioned in April, 1913. This scheme was later revised, and sanction for Rs. 8,54,948 was obtained in July, 1914. In November, 1918, the matter was again taken up and a further revised scheme called for, and the Government of Mysore, approving of the opinions of the chief electrical engineer, directed that the traffic prospects be re-investigated, and estimates and plans prepared at an early date.—*Indian Engineering.*

Liverpool.—ELECTRIC VEHICLES.—A number of electric mail vans will figure in the first commercial motor parade to be held in Liverpool, on Saturday, the 25th inst. Messrs. J. Blake & Co., mail contractors, have recently introduced electric vehicles into the local mail-carrying services.

London.—UNDERGROUND FARES.—The *Evening News* states that, although the general minimum of the new scale of fares, to be instituted on September 26th, will be 1½d., a few penny stages are to be retained in what are termed the "poorer" districts of the Metropolis. The average rate is said to be about a penny per mile, and workmen's fares are to be increased considerably.

North-Eastern Railway.—PROPOSED ELECTRIFICATION.—The chief engineer of the North-Eastern Railway Co. has recently paid a special visit to America to investigate the situation there, and the company has already considered plans for electrifying the important line of traffic between Newcastle and York. The pressure of war traffic between the minefields of Durham and the blast furnaces of Teeside proved the value of the electrified railroad for heavy freight traffic between Shildon and Stockton-on-Tees. A strong Departmental Committee has reported unanimously to the Minister of Transport its decision that there should be a standardisation of electrical equipment for future railways. —*Morning Post.*

Stockton.—TRAMWAY PURCHASE.—A small Sub-Committee of representatives of the Stockton and Thornaby Corporations has been appointed, with plenary powers, to take all necessary steps in connection with the provision of the purchase money for the tramway undertaking in Stockton and Thornaby.

Wolverhampton.—CHANGE OF SYSTEM.—The Chamber of Commerce has asked the Town Council to consider the advisability of withdrawing its scheme for converting the tramways and substituting therefor a motor-'bus service, on the ground (*a*) that the cost of replacing the present system by the overhead system is prohibitive, and (*b*) that a system of petrol or electric vehicles gradually instituted to replace the trams would probably be more efficient and less costly than the proposed tramways. When the communication was considered at the meeting of the Town Council, two members disagreed with the Chamber's contention that motor-'buses were cheaper. It was agreed, however, to refer the letter to the Tramways Committee.

TELEGRAPH AND TELEPHONE NOTES.

Canada.—AUTOMATIC TELEPHONES.—The Northern Electric Co. announces a contract agreement with the Automatic Electric Co., of Chicago, whereby it has acquired exclusive Canadian patents and rights to manufacture and sell Strowger automatic telephone equipment in Canada and Newfoundland. This arrangement places the Northern Electric Co. in the position of being able to supply all telephone companies with their complete requirements of manual equipment, automatic apparatus, and machine-switching apparatus.

Germany.—BELGIAN TELEPHONE CLAIM.—After constructing a new suburban telephone exchange in Berlin for 4,000 subscribers, the German Ministry of Posts is now faced with a demand from the Belgian Government for the restoration of the material so used, on the ground that it was removed from Belgium during the war by the German military authorities.—*The Times.*

Hanover.—FRENCH CLAIM SETTLED.—An agreement is reported to have been reached on the subject of the future of the German wireless station at Eilwese, between the German company and the French claimants. By its terms the French company is to be compensated by money payment, and is to be given the right to use certain German patents abroad which were in dispute. Eilwese is to be turned into a German limited company, in which the German High Frequency Co. and the Telefunken Gesellschaft are shareholders. The station, which played a large part in German propaganda during the war, is to be devoted to trans-oceanic wireless service.—*The Times.*

Holland.—WIRELESS TELEPHONY.—A Commission will leave for England next week, having been charged by the Ministry of Public Works to inspect various wireless telephonic meteorological installations that have been established in this country in the interests of airmen. The Commission is composed of Dr. Cannegieter, director of the Meteorological Institute at De Bilt, Capt. Klaus, head of the radio-telegraphic service of the Aeronautical Department at Soesterberg, and M. de Voogd, a telegraph engineer.—*Reuter's Trade Service* (The Hague).

Wireless Direction Finding.—LIZARD STATION.—The Lizard wireless direction-finding station, which was recently closed, is to be re-opened by order of the Admiralty after reconstruction of the antenna system.

CONTRACTS OPEN AND CLOSED.

(The date given in parenthesis at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW, *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Commonwealth Government. November 24th. Protected cable terminals and cable distribution boxes.

BRISBANE.—December 9th. Department of Public Works. Seventy three-phase oil-cooled core type static transformers.

January 20th, and February 25th, 1921. The City Electric Light Co. 10,000-KW. turbo-alternator set; transformers and switchgear.

QUEENSLAND.—November 24th. P.M.G.'s Department. Iron poles (schedule 506), protected cable terminals, cable distributing boxes (schedule 507).

November 30th. P.M.G.'s Department. Protectors (schedule 505). (See this issue.)

NEW SOUTH WALES.—November 25th. P.M.G.'s Department. Telegraph and telephone instrument and switchboard parts (schedule 753).

SOUTH AUSTRALIA.—November 11th. P.M.G.'s Department. Telephone instruments (schedule 547). (See this issue.)

MELBOURNE.—February 24th, 1921. The Victorian Electricity Commissioners. Turbo-alternators of 25,000, 12,500 and 600 KW., and other plant connection with the Morwell power scheme.

QUEENSLAND.—October 6th. P.M.G.'s Department. Instruments and parts (schedule 499). (September 10th.)

SOUTH AUSTRALIA.—October 20th. P.M.G.'s Department. Telegraph instruments (schedule 546), and telephone instruments (schedule 549). (September 10th.)

November 3rd. P.M.G.'s Department. Telephone instruments (schedule 548). (September 10th.)

Bradford.—October 28th. Electricity Department. Two natural-draught chimney-type cooling towers, pipework, troughing, valves, &c. (Contract R 160). (See this issue.)

Edinburgh.—September 27th. Electricity Supply Department. Coal, ash and flue-dust handling plant, circulating pumps and pipework. (August 27th.)

Costa Rica.—January 10th. Concession for the construction of an electric tramway, 22 km. long, from Alajuela to Grecia. Government guarantee of 6 per cent. on part of capital. Secretariat of Public Works, San José, Costa Rica, or, in France, Office National du Commerce extérieur.

India.—AGRA.—October 22nd. Municipal Board. Complete generating plant, comprising: four Diesel engines and H.T. alternators; H.T. and L.T. switchgear, transformers and sub-station equipment; 15 miles underground H.T. cables, 28 miles overhead L.T. three-phase mains and street lighting equipment, complete with all accessories. (August 20th.)

Lincoln.—October 8th. Electricity Department. Spray cooling plant, 500,000 gallons per hour, with pipe and pipework. (September 10th.)

London.—METROPOLITAN ASYLUMS BOARD.—September 29th. Extensions to the telephone installation at the Grove Hospital, Tooting. (September 10th.)

Manchester.—October 20th. Electricity Committee. Specification No. B.9. Five 8,500 K.V.A. 3-phase transformers and fans, &c.; and three 6,000 K.V.A. 3-phase transformers and fans, &c. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

September 28th. Tramways Committee. Tramway poles and sleeves, for the Tramways Committee. Mr. J. M. McElroy, general manager.

New Zealand.—INVERCARGILL.—October 19th. A specification and conditions of tender for the wires, cables, and overhead equipment required by the Tramways and Electricity Department can be seen on application immediately to Mr. Holloway, Room No. 48, at the Department of Overseas Trade, in London.

Rochdale.—Board of Guardians. Installation of new telephones at the Institution and Hospital, Birch Hill. (See this issue.)

Sheffield.—October 12th. Electric Supply Department. Two 10,000-KW. steam turbines, condensing plants, pipework, &c., alternators and exciters. (September 10th.)

St. Helens.—September 30th. Electricity Department. Cast-iron low pressure water piping, and one natural draught cooling tower. (September 10th.)

Uruguay.—December 18th. The Post Office authorities are, for the second time, inviting tenders for the construction of an underground telephone system here.—*Reuter's Trade Service* (Monte Video).

CLOSED.

Gillingham (Kent).—The Park Engineering Co. (A. E. Hornsby & Co.), Gillingham, has secured the contract for the electric light installation work in the whole of the houses now being erected under the Gillingham Corporation Housing Scheme.

Newport (Mon.).—There was an interesting discussion at last week's meeting of the Corporation regarding the acceptance of a foreign tender.

Mr. Raikes submitted a report on his visit to electrical works in Switzerland, with the borough electrical engineer, to examine turbo-alternator plants, and recommended that the tender of Messrs. Escher, Wyss & Co., of Zurich, for a turbine be accepted. They visited the works of Messrs. Brown, Boveri & Co., Baden, and Messrs. Ateliers de Construction Oerlikon Co., Oerlikon. Mr. F. P. Robjent strongly objected to accepting the foreign tender, and moved that the matter be referred back, with a view to a tender from a British firm being accepted. In England they were obliged to pay Trade Union rate of wages—but was this firm paying it? Mr. W. F. Harding seconded the reference back. Mr. W. E. Robertson said all this was sloppy sentimentality. Accepting this tender meant a saving of about £5,000 to the ratepayers. Mr. Frank Quick said the pernicious ring among the British manufacturers did not allow them to tender at a reasonable price. The forgings, castings, and sheets of this foreign turbine were made in England, yet this foreign firm could sell it thousands of pounds cheaper because of the British ring. Mr. John Moxon said the Zurich firm were tip-top in their class, and had rendered spendid service to the British Government during the war. Since then the Powell Duffryn Colliery Co. and others had given them big orders. The foreign tender was accepted, only two votes being cast for reference back.

Wishaw.—

J. & H. Michie.—Electric lighting installation at Thornlie U.F. Church.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, October 1st. In the Great Hall, Cannon Street Hotel, E.C., at 8 p.m. Smoking Concert.

Electrical Power Engineers' Association (Manchester Section).—Saturday, October 2nd. At Milton Hall, Deansgate, Manchester. At 6.30 p.m. Address by Mr. Essex, Secretary of the N.E. Division.

Chief Technical Assistants' Association.—Saturday, September 25th. At Anderton's Hotel, Fleet Street, E.C., at 3 p.m. Paper on "Maintenance of Tramway Equipment," by Messrs. E. H. Manly and G. V. S. Stanley.

Junior Institution of Engineers.—Friday, October 1st. At Caxton Hall, Victoria Street, S.W., at 8 p.m. Paper on "Notes on Factory Management," by Mr. H. N. Munro.

Machine Tool & Engineering Exhibition at Olympia, W.—Last day, September 25th.

NOTES.

Electrically-Treated Seed.—An experiment in methods of electrically-treating seed has been tried this year in Oxfordshire by Capt. Dashwood at Manor Farm, Duns Tew, with good results. Cornfields were sown with both ordinary and treated seed, and corn grown from the latter is stated to be much longer, with thicker stems and looks much stronger. "In the majority of cases," Capt. Dashwood is quoted as saying, "the heads of treated seed are much longer. The process greatly increases the yield and provides better seed for future planting. It reduces risk of wire-worm and fungoid diseases, all at a cost of a few shillings per acre."

Mica.—Those interested in deposits of mica should note the statements in the United States Geological Survey *Press Bulletin*, No. 448, June, 1920, that sheet mica to be of value must yield rectangles at least 1·5 by 2 in., which must split easily and evenly, be free from cracks, markings, fracture lines, and reasonably free from specks of foreign mineral matter. The size mentioned is the smallest rectangular size that is saleable as uncut sheet, and the rough-trimmed mica sheet must be nearly twice as large to yield the rectangle stated. In order to be profitable, most deposits must also contain some mica larger than the above-mentioned size. Good sheet mica should be so flexible that a sheet $\frac{1}{1000}$th in. thick, can be readily bent into a cylinder ¼ in. in diameter without showing any cracks. The Geological Survey recognises seven different degrees of hardness. The production of the various kinds of mica in the U.S.A. ranges from 3,000 to 5,000 tons per annum.

Institution Notes.—MANCHESTER WIRELESS SOCIETY.—On September 8th, Mr. C. Morris gave a lecture on amplifying valves to the members of the Society and the public. Various types of valve were described, and their merits outlined. The speaker gave a number of demonstrations, and a "wireless" musical programme was given by means of a receiving set. The Air Ministry's weather reports were also received. Messrs. S. R. Millard kindly lent a number of instruments for the demonstrations.

Inquiries.—A correspondent asks for the address of makers of "Two-way leading-in porcelain tubes for corrugated iron roofs, Woodworth's patent." Makers of an electric soldering iron with the heating element pressed into an aluminium block, and agents for the Hamilton-Beach Manufacturing Co.'s sewing-machine motors, are also asked for.

The World's Copper Output.—According to *Nature*, which quotes a report by the U.S. Geological Survey on the world's production of copper in 1917, America produced in 1913 about 57 per cent. of the world's output of just under one million tons, and the high-water mark was reached in 1917, when a grand total of 1.454 million tons was extracted. Of this the U.S.A. produced 0.855 million tons. Japan and Chile also increased their smelter production to a little more than 100,000 tons. Then follow Canada, Mexico, and Peru. By far the greater part of the world's copper was derived from the western hemisphere, and it is evident that the U.S.A. is the largest single factor in nearly every phase of the industry. At present she is not only much the largest producer and consumer, but also excels in both imports and exports. At the beginning of 1917 the producing capacity was the largest in the history of the industry, and was almost wholly utilised. The principal producing State was Arizona, followed by Montana, Michigan, and Utah. These four States provided 79 per cent. of the total American output in 1917.

The Electro-Harmonic Society.—The 35th season of this Society opens with a smoking concert on Friday, October 1st, in the Great Hall, Cannon Street Hotel, commencing at 8 p.m. Will readers please take note of the change of place? The dates of the other concerts for the season are :—

Friday, November 12th	Ladies' Night.
Friday, December 17th	Smoking Concert.
Friday, January 14th	Smoking Concert.
Friday, February 11th	Ladies' Night.
Friday, March 11th	Smoking Concert.

At the concert on Friday, October 1st, Mr. W. J. Tennant will take the chair, and the artistes will be as follows :—Mr. W. Glynne, tenor; Mr. Tom Kinniburgh, bass; Mr. Paul Brunet, violin; Mr. Nelson Jackson, entertainer; Mr. Will Bentley, humorous songs; Mr. Archie Naish, humour at the piano; Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist.

Educational.—Bradford.—The new session's calendar of the Bradford Municipal Technical College gives details of the full-time and part-time evening courses in textile, chemical and engineering—including electrical—industries. Ordinarily, students who have not passed the matriculation examination—the courses being of University standard—have to pass a college entrance examination of equal standard, but special provision is made for students who have been in whole-time industrial employment for several years and wish to enter a full-time course. The part-time courses are for students already engaged in industry, and provision is also made for research. Close co-operation with leaders of industry is maintained by the formation of an engineering advisory committee, comprising representatives of engineering firms and of Trade Unions. As a result of recommendations of this committee, considerable developments have taken place in the engineering departments, and special courses for the training of engineering apprentices have been established. A special class has been arranged for the new session in descriptive electrical engineering for men not engaged in the industry, but who may have private electrical plant for lighting and power; the course includes theory and practice.

Northampton Polytechnic Institute.—Evening courses in Mechanical and Electrical Engineering will commence on Monday, September 27th. Full time sessional day courses in Engineering and Technical Optics will commence on October 4th. For particulars see our advertisement pages to-day.

Air Conference, 1920.—The Air Ministry announces that, owing to the rapidly-increasing importance of aviation, the Air Council is to call together an Air Conference. Its more immediate object will be to bring representatives of all sections of the community into contact with the practical work being done to-day, with a view to assisting future progress. The Lord Mayor has granted permission to hold it in the Council Chamber of the Guildhall, London, and has also consented to open the proceedings on the first day. It will take place on October 12th, 13th, and 14th, 1920, attendance being by invitation. The subject for consideration on the first day will be civil aviation. The second day will be devoted to technical questions; and on the third day the broader aspects of service aviation will be dealt with. After each of the several papers have been read, the subject dealt with will be open to discussion by those present.

Fatality.—An inquiry was held, on the 15th inst., into an electrical fatality which occurred at Harton Colliery, near South Shields, which caused the death of George Nicholas Laidler, an engineman, of Tyne Dock. The evidence showed that the deceased and some other men had been removing some old gear at the pit-shaft, and were using a winch for the purpose. They had only been engaged for a few minutes, when all received a severe electric shock, and were thrown down. Three soon recovered, and they found Laidler lying unconscious, and despite medical attention, he never recovered. Examination showed that the steel haulage rope connected with the winch, when tightened, had come in contact with the electric lighting cable and had cut it in two. The Coroner entered the man's death as due to accidental causes.

Electricity in Metal Production.—An enormous stride has been made in the last decade in the use of electricity for electro-metallurgical processes in Canada and the U.S.A. In 1910, says the *Electrical News*, only 25 cities in the two countries possessed electro-chemical or electro-metallurgical loads, but at the present time the number is 200, and the total load has reached approximately 1,300,000 K.V.A., exclusive of motor load. The production of pig iron from the ore by electrical processes has now been discarded, but it is still being produced from scrap electrically melted. Steel production furnishes the heaviest load in this field, the estimated power taken being 600,000 K.V.A. Aluminium occupies the second place with a load of 350,000 K.V.A. Electricity is used in the production of other metals to the following extent :—Ferro-alloys, 200,000 K.V.A.; zinc, 60,000 K.V.A.; copper, 45,000 K.V.A.; brass, 23,000 K.V.A.; lead, 1,400 K.V.A.; and gold and silver, 1,000 K.V.A. In other countries, particularly in Sweden, the electrical reduction of iron ores has progressed steadily, until the transformer capacities in K.V.A. used in this connection are to-day approximately as follows :—Sweden, 64,000; Italy, 18,000; Switzerland and Japan, each 6,000, and Norway 6,600, a total of 100,600 K.V.A. The power consumption in the furnaces employed for the production of iron from ores ranges from 2,000 to 3,000 KW.-hours per ton of pig iron produced, the former figure representing the consumption for white iron, and the higher figure for grey iron. The Swedish furnaces use three-phase power at 25 or 60 cycles, with a secondary transformer range of from 50 to 100 volts—usually 80 volts. The furnaces have each six electrodes, one pair being connected to each of the three transformers employed. Electricity is extensively employed for refining grey iron from the cupola. Iron treated in this way shows a marked decrease in sulphur and increase of strength. The number of electric furnaces being utilised in the production of steel is estimated at 875 for all countries: of these 323 are installed in the U.S.A. and 40 in Canada. The production of the former country during 1917 was 304,543 gross tons, of which about 50 per cent. was alloy steel. The most marked development of the electric steel furnace has been in the production of ingot alloy steels for automobile construction and high-speed steel. The electric furnace operating with a basic lining has an output far better than that of the crucible furnace. Lower grade raw materials can be used owing to the ease with which the metal is refined by means of electricity. Owing to the poor market for ferro-alloys, 75 per cent. of the plants in the U.S.A. have had to shut down, but an advance in the price of ferro manganese some months ago from $100 to $250 per ton caused the resumption of working at two of the largest plants. Aluminium is gradually becoming more and more important, and the output of the U.S.A. rose from only 12,000,000 lb. in 1910 to 225,000,000 lb. in 1918. It is practically certain that the production of aluminium, which is always an electrical process, will, in the near future, overtake the total production of lead and zinc, which at present is in advance. The electric brass furnace is rapidly becoming an important load for the central station. The electrolytic production of lead and zinc, which are more modern processes, is also advancing rapidly. In this country, Mr. Samuel Field has shown in his paper on "Electrolytic Zinc," read before the B.A. (Elec. Rev., September 3rd, p. 294), more attention has recently been given to this important industry.

The use of electric furnaces in Great Britain was given a great impetus by the war, which necessitated an enormously increased output. In 1914, according to Mr. D. F. Campbell, who recently read a paper on the subject before the Society of Chemical Industry, the total amount of energy used in this connection, excluding aluminium furnaces, probably did not exceed 6,000 H.P. At the conclusion of hostilities the total had reached 150,000 H.P., the bulk of which—135,000 H.P.—was being employed in steel production. The latter was then about 200,000 tons per annum. About 18,000 H.P. was used in the reduction of tungsten and chromium ores.

Cricket Match.—A cricket match was played at the Osram-G.E.C. Sports Ground at Wembley, on the 11th inst., between teams from the Osram-G.E.C. Lamp Works and Witton Engineering Works. The Lamp Works team proved the winners, and as a result hold for a year the Championship Cup competed for each year by teams from the head office, branches, and works of the General Electric Co., Ltd. For the purpose of the competition the country was divided into two areas—the Northern and the Southern. Teams from the works and branches in the districts north of, and including, Birmingham were in the northern area, and teams from the works and branches south of Birmingham were in the southern area. Witton Engineering Works were the winners in the northern area, and the Osram-G.E.C. Lamp Works were the winners in the southern area, Head Office being their strongest competitors. The winners in each area met at Wembley for the championship. The Lamp Works won the toss, and batted first. After a shaky start, they finally put up the good score of 142 for 7 seven wickets. Witton Engineering Works were unlucky in getting a man out for one run, and did not seem to recover from this bad start. Eventually all were out for 64. After the match both teams and the visitors (of whom there were many from the company's various works and branches) dined at the Charendon Restaurant, Hammersmith, under the chairmanship of Mr. E. T. Driver, and later adjourned for a billiards competition and other diversions.

Electrical Treatment for Blindness.—The *Birmingham Post* publishes a Reuter note stating that Doctor Gustav Erlanger, of the University of Berlin, has discovered a treatment for manulæ, or blindness caused by tissues covering the eyeball. Doctor Erlanger has been continuing the experiments begun by Swiss scientists, and his treatment consists of placing one electrode on the eye and another at the back of the head, and by means of these passing chloride ions into the tissues of the eye. No pain is caused to the patient, and a treatment of only two minutes three times a week is necessary. Sight returns gradually over a period of several weeks. The invention should be especially valuable to war victims of gas attacks, who, blinded by German chlorine, are now offered a tardy chance of recovery by means of this German invention, which employs a substance closely related to chlorine, this time in a healing capacity.

Appointments Vacant.—Cable jointer, for the Heckmondwike Urban District Council Electricity Works; chief engineer and general manager for an Electric Supply and Traction Co. in India; engineer to take charge of a shift (£350) for the Newcastle-on-Tyne Electric Supply Co., Ltd.; teacher in electrical engineering (£350), for the St. Helens Municipal Technical School; telegraph engineers ($360 per month + 20 per cent., $ = 2/4), for the Government of the Federated Malay States and Straits Settlements; telegraph engineering assistants (£350 + 50 per cent.), for the Government of Tanganyika Territory Posts and Telegraphs Department; accounts and ledger clerk (£275), general accounts clerk, general clerk, and a sales department salesman (£220), for the Hackney Borough Council Electricity Department. (See our advertisement pages to-day.)

Industrial Medicine.—A medical correspondent of *The Times* says that St. Mary's Hospital proposes to set up a Chair of Industrial Medicine, to train doctors in the care of the workers in factories. In the United States there are six chairs in this subject.

The Metric System.—The report of the Metric Committee appointed in 1916 by the Conjoint Board of Scientific Societies to inquire into the compulsory adoption of the metric system in the United Kingdom was published recently "on the authority of the committee." The report was first prepared in June, 1917, and was submitted to the constituent societies; it was discussed at a special meeting of the Conjoint Board on November 12th, 1919, at which apparently opinion was much divided, and the report as now issued does not bear the imprimature of the Conjoint Board. It must, therefore, be understood to represent the views of the majority of the Committee, namely: Mr. H. W. Fox, Sir R. A. Hadfield, Mr. A. R. Hinks, Sir Philip Magnus, Profs. J. Perry, W. C. Unwin, and W. W. Watts. The remaining members of the Committee, who did not sign the report, were Sir Joseph Thomson, the Duc de Broglie, and Mr. C. P. Sparks.

The Committee interpreted its terms of reference very broadly, and in a prefatory note it is stated that "the Committee are entirely unable to agree with the view expressed on discussion of the report, that they should have confined themselves to the scientific aspects of the question. On these there is no real difference of opinion." It is clear, therefore, that at the discussion the Committee was given to understand that it had exceeded its terms of reference, and that the report was not adopted by the Board. No witnesses were called, the Committee relying upon the evidence given before Lord Balfour of Burleigh's Committee on Commercial and Industrial Policy after the War.

The report outlines the history and nature of the metric system, the British system of weights and measures, proposals for the compulsory adoption of the metric system by the British Empire and their merits and demerits, the volume of trade adversely affected by the present conditions, and decimal coinage, and in conclusion recommends that the British system of units of weights and measures be retained in general use in the United Kingdom, without modification and without the addition of new fundamental units; that steps should be taken towards compiling statistics in metric units, or in metric and British, but not in British alone; that serious attention be given to the decimalisation of British weights and measures, and to the expression of quantities in terms of a single unit; that the pole, furlong, and league be abolished, and the link and chain used only for the delimitation of area; that the grain, dram, stone, quarter, and hundredweight and the whole of apothecaries' weights be abolished; that measurement by weight be substituted for measurement by capacity; that the use of the metric system be made compulsory in the whole trade in fine chemicals and drugs; and that no change in the existing system of British coinage be attempted.

Several appendices are attached to the report, together with resolutions and criticisms received from the constituent societies; many of these are vague or explicitly non-commital, but some definitely support the recommendations, and a few are frankly hostile to them.

Crewe Signal-box Fire.— Early on the morning of September 10th the Crewe South signal-box, one of the largest electrical signal boxes in the world, caught fire and before the flames could be extinguished considerable damage was done to the electrical plant, with the result that the whole of the points and signals which govern all trains entering and leaving Crewe Station at the south end were put out of action, and trains were kept standing for some time. The whole of the telephonic and telegraphic installations were destroyed. No instance in this country can be recalled where such a mishap will cause more inconvenience than the fire reported above. For at that point the four running lines to and from the south, the two of the Shrewsbury line, and the two of the North Staffordshire, converge and fan out into ten through lines and six bay lines in the station, besides sundry goods lines and siding connections. In the box there was a locking frame of 247 levers, which, with the 266 in the North Junction box at the other end of the station, formed part of an installation of over 1,000 electrically-operated levers at Crewe, including the marshalling yard. A locking frame of such magnitude is not readily replaced; being of the miniature pattern used in this and other power frames there, will not be in stock the number of spare parts that would be the the case with an ordinary mechanically-operated frame. The interlocking would need making throughout, but, fortunately, the "dog-sheet" of the original frame would be sure to be in existence, and it is safe to assume that it would be recopied in the new frame. It is presumed that the fire was caused by fusing.—*Railway Gazette.*

Proposed Sea Tunnels.—Renewed attempts are being made to build a tunnel under the Straits of Gibraltar. The original estimate was placed at between £9,000,000 and £10,000,000; but this figure will fall far short of present-day prices and wages. A tunnel would facilitate traffic between Europe and South America. Passengers leaving Paris by the proposed route could reach Dakar (Senegal) in three days without changing trains, and a sea journey of four days would land them in Rio de Janeiro, says the *Railway Gazette*. The same journal records that at a meeting of the Royal Isle of Wight Agricultural Society at Newport on September 11th, Sir Charles Seely presiding, a resolution was passed that the society favoured the construction of a tunnel under the Solent as the best means of improving the present inadequate means of communication between the island and the mainland, but could not at present support any measure which would increase the already heavy rate burden. The chairman said it was for the railway companies affected to make the first move in the matter of the tunnel, which would enormously increase railway traffic to and from the island. As to the suggestion of the Minister of Transport that a train ferry would be more practicable, Sir Charles Seely said that train ferries had proved suitable and satisfactory elsewhere, and one advantage of such a scheme was that a trustworthy estimate of the cost could be obtained.

With regard to the English Channel, Mr. Bonar Law, in reply to questions in Parliament, stated recently that although the military authorities had expressed an opinion on the proposed tunnel the Government had not had time to reconsider the project.

A Dynamometrical Comparator.—Due to inherently lower precision of A.C. measurements, more accurate results are often obtained by transferring with the aid of a comparator the A.C. measurements into D.C. measurements of a related type. The dynamometrical comparator for accurate comparison of A.C. and D.C. strengths, acting as a differential dynamometer with its coils connected as two arms of a Wheatstone bridge, constructed by Mr. C. O. Gibbon, of the Electrical Engineering Research Division of the Massachusetts Institute of Technology, even in its first experimental form, proved capable of most remarkable sensitivity and accuracy. In the hands of Mr. Edy Velander, of the same Institute, who illustrates and describes the instrument in the July, 1920, issue of the *Journal* of the A.I.E.E., the differential dynamometer has reached a second stage of development. By the introduction of a special control box its manipulation has been much simplified, and means have also been provided for the quick and accurate adjustment of the comparator ratio at any time during the use of the apparatus for measuring purposes. An analysis of the main sources of error shows that the accuracy of the instrument is extremely high, the readings being reliable to within a few hundredths of 1 per cent. The device has very successfully been applied to various types of practical current measurement, in fact in conjunction with a D.C. potentiometer, it seems to offer the most accurate means which are known at the present time for the determination of the R.M.S. value of alternating currents of the order of from 5 to 50 milliamperes, at frequencies up to about 2,000 P.P.S. Already in its present form the dynamometrical comparator has thus proved to be a very useful laboratory instrument. Certain definite suggestions are made, however, in the paper referred to above concerning further improvement in the apparatus.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Mr. Walter Swift, a member of the technical staff of the British Insulated and Helsby Cables, Ltd., at their Helsby offices, has been presented with a case of fish knives and forks, on the occasion of his marriage. The presentation was made by Mr. H. Higham.

Mr. W. D. Brassington, mains superintendent of the Clyde Valley Electrical Power Co., has been presented by the staff with a roll-top desk on leaving to take up the position of electrical engineer to the Motherwell Town Council.

The Times reports that Sir Thomas and Lady Callender and Mr. T. Callender have left for the East by the P. & O. ss. *Karmala*.

Mr. F. V. Wallis, chief draughtsman at Messrs. Wilson Hartnell & Co. Ltd., electrical engineers, Leeds, has been presented by the head office and technical staffs, with a case of knives and forks, on the occasion of his marriage.

Dr. O. S. Sinnatt, M.C., D.Sc., M.Sc., at present lecturer in Mechanical Engineering, London University, King's College, has been appointed to the Professorship of Aeronautical Science at the R.A.F. Cadet College, Cranwell.

Mr. A. Brown has resigned the position of Manager to Messrs. Isaacson & Brown, Ltd.

The Times reports that after his last lecture Professor Sir Ernest Rutherford was admitted to be Doctor *honoris causa* of Copenhagen University.

Obituary.—Sir William Mather.—We regret to record the death of Sir William Mather, which occurred at Bramshaw, New Forest, on Saturday last, in his 83rd year. Sir William was the son of the elder of two brothers who founded the Salford Ironworks, which have for so many years been world-famous as Mather and Platt, Ltd. It was after his education in this country and at Dresden that he served an apprenticeship in mechanical engineering with his father's firm. He worked from 6 o'clock in the morning with the other apprentices and attended evening class lectures at Owens College. He became a partner in the firm in 1862, and in 1871 took over the sole management of the business. In 1877 the elder partners retired from the firm. He was for 10 years a member of the Salford School Board, and in the course of his political career, represented several constituencies in Parliament. In 1892 the business was turned into a limited company under his

chairmanship, and in the following year, profiting from the practical experience of working men's conditions that he had gained under the discipline imposed by his father, he introduced the eight-hours' day. He said he was convinced that the work done before breakfast was of very little value, and that with goodwill all round, as much work could be accomplished in a 48-hour week as in one of 54 under the old conditions. Wages remained the same, but he claimed that the belief that he held was fully justified by the result. He personally investigated industrial methods and conditions of labour in other countries, was an enthusiast of wide experience in matters relating to technical education. Forty years ago he was a member of a Royal Commission, which investigated technical education in United States and Russia. Much might be said to show his deep interest in educational matters, but we may select for mention one of his many benefactions in this connection, namely the erection at his expense of an Educational Hall in the grounds of the Franco-British Exhibition of 1908, wherein authorities lectured on educational matters. He also travelled in different parts of the world in the interests of the business of his firm, whose trade connections have for many years been world-wide. He was knighted in 1902, and made a Privy Councillor in 1910. Sir William was a member of the Institutions of Civil and Mechanical Engineers and of the Iron and Steel Institute. Sir William Mather was unquestionably a leader among engineering employers, enlightened, and humane in regard to industrial conditions and enterprising and progressive in matters of business. In his declining years he had left the practical control of affairs in other hands, but his influence as an employer will long outlive him.

Sir James B. Ball.—We regret to record that Sir J. B. Ball, chief engineer of the L.B. & S.C. Railway, passed away suddenly on September 16th, at Forest Row, Sussex, while on a visit to Sir Wm. Forbes, the general manager of the company. He was 53 years of age.

Mr. J. H. Thornton.—Mr. John Henry Thornton, senior partner in the firm of Frank Thornton & Co., electricians, Bridge Street, Burnley, died last week. He was 61 years of age. The electricians' business was founded by his son, Mr. Frank Thornton, some 14 years ago.

The body of Mr. J. E. Edmundson, manager of the Urban Electric Supply Co., Ltd, at Hawick, was found on the railway near the town on Saturday. He had been terribly injured, being almost decapitated, and his right hand was also cut off. Mr. Edmundson went to Hawick less than two years ago from Grantham, where he had held a similar position.

NEW COMPANIES REGISTERED.

Buenos Aires Town & Docks Tramways, Ltd. (170,069).—Registered September 4th. Capital, £500,000 in £1 shares. To enter into an agreement with Claude W. H. Lowther, John G. B. Stone, The Beaver Trust, Ltd., Sir Wm. Plender, and Buenos Aires Port and City Tramways, Ltd., to acquire and carry into effect contracts or concessions for the construction, repair, maintenance, operation, control of railways, tramways, and other roads or ways to be used for traction by electricity or other agency, and for the equipment of any such undertakings with electric or other plant, &c. The subscribers (each with one share) are: F. J. French, 105, Winchester House, E.C. 2, registrar; S. A. Gay, 105, Winchester House, E.C. 2, clerk, and five other clerks. Minimum cash subscription, 7 shares. The first directors are to be appointed by the subscribers. Qualification (except first directors), £100. Remuneration, £300 each per annum (£200 extra for the chairman). Solicitors: Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.

Pollock & Macnab (Subsidiary), Ltd. (170,083).—Private company.—Registered September 6th. Capital, £30,000 in £1 shares. To adopt an agreement between Pollock & Macnab (1919), Ltd., and T. G. F. Grundy for the sale and purchase of a plot of land and heriditaments, at Bradbury, Ches., and to carry on the business of iron and metal founders, mechanical and electrical engineers, &c. The first directors are: D. Adamson, The Longlands, Godley (member of Joseph Adamson & Co.); J. Macnab, Oakfield, Arkwright Road, Marple (director of Pollock & Macnab (1919), Ltd.); J. E. Shenton, Lower Bennett Street, Newton (director of Tinker, Shenton & Co., Ltd.); J. C. Beeley, 20, Amherst Road, Withington (director of Thomas Beeley & Son, Ltd.). The above may hold office so long as they continue to be members or directors of their respective companies. Qualification, £1,000. Secretary: H. Absom. Registered office: Britannia Machine Tool Works, Redhouse Lane, Bredbury, Ches.

H. C. Siddeley & Co., Ltd. (170,065).—Private company. Registered September 4th. Capital, £5,000 in £1 shares. Secretaries, engineers, agents, merchants, importers, exporters, stock and share dealers, underwriters, &c. The first directors are: J. A. Hirst, Donacloney, Deganwy, N. Wales (director Brook Hirst & Co., Ltd.); E. N. Humphreys, Caer-y-cae, Hoole Road, Chester (director East Halkyn Mining Co., Ltd.); H. C. Siddeley, Australia House, Strand, W.C. 2 (director of British Engineers and Traders Syndicate, Ltd.) Secretary (pro tem.): E. N. Humphreys. Registered office: Australia House, Strand, W.C. 2.

Associated Electric Traders, Ltd. (170,092).—Private company. Registered September 7th. Capital, £10,000 in £1 shares (3,000 preference). To carry on the business of wholesale and retail importers, exporters, and manufacturers of and dealers in alabaster bowls, marble figures, electric light fittings, shades, lamps, switches, &c., and to adopt an agreement with J. Leitch. The subscribers (each with one share) are: J. W. R. Williams, 13, Greencroft Gardens, Hampstead, N.W., manager electrical fittings factors; A. Phelp, 10, Old Steine, Brighton, gentleman. J. W. R. William signs as director. Qualification, £25. Registered office: 2, Percy Street, Tottenham Court Road, W. 1.

Cutting & Muir, Ltd. (170,164).—Private company. Registered September 10th. Capital, £5,000 in £1 shares (2,500 10 per cent. cumulative preference). To take over the business of electrical and mechanical engineers carried on by G. B. Cutting and T. Muir at 29, St. Matthew's Street, Ipswich, as "Cutting & Muir." The first directors are: T. Muir, 94, Derby Road, Ipswich; G. B. Cutting, 29, St. Matthew's Street, Ipswich. Registered office: 29, St. Matthew's Street, Ipswich.

Direct Electric Service (Bury), Ltd. (170,264).—Private company. Registered September 16th. Capital, £2,500 in £1 shares. To carry on the business of electrical and steam engineers and contractors, suppliers of electricity, &c. The first directors are: A. W. Sweetinburgh, 43, Irwell Street, Bury; F. D. Law, 42, Hamilton Street, Bury; J. C. Carruthers, 87, Rochdale Road, Bury. Qualification 100 ordinary shares. Registered office: Back Fleet Street, Bury.

Excelall Metal Workers, Ltd. (170,098).—Private company. Registered September 7th. Capital, £4,000 in £1 shares. To take over the business of electrical and mechanical appliances manufacturers, sheet metal workers, stampers, piercers, solderers, welders, polishers and platers, &c., carried on by Pressparts, Ltd., at Excelall Works, Sampson Road North, Birmingham, and to adopt an agreement with W. G. Hill. The first directors are: E. B. Alldridge, 1, St. Mary's Road, Harborne, Birmingham; A. C. Lee, 107, Wake Green Road, Moseley, Birmingham; G. R. Groves, 12, Ben Street, Rugby. Registered office: Excelall Works, Sampson Road North, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Barnsley & District Traction Co., Ltd. (72,962).—Return dated July 30th, 1920. Capital, £100,000 in £1 shares (50,000 preference), 22,000 preference and 20,035 ordinary shares taken up, £42,035 paid. Mortgages and charges, £21,000.

Woodbridge & District Electric Light Co., Ltd.—Issue on August 27th, 1920, of £30 debentures, part of a series.

British Electric Vehicles, Ltd.—Satisfaction in full on September 2nd, 1920, of £30 debentures dated September 14th and January 17th, 1917, securing £2,000.

Windsor Electrical Installation Co., Ltd.—(A) Satisfaction in full on August 19th, 1920, of debenture dated July 2nd, 1919, securing £5,000. (B) Debenture dated August 19th, 1920, to secure £8,000 charged on the company's undertaking and property, present and future, subject to £8,800 prior debentures. Holder: Sir Alexander W. Shipley, Kt., Riverbank, Datchet, Bucks.

Ackroyd & Best, Ltd.—Issue on August 18th, 1920, of £120 debentures, part of a series already registered.

Riglite Manufacturing Co., Ltd.—J. F. Legg, of 11, Queen Victoria Street, E.C., as receiver on September 2nd, under powers contained in debentures dated June 18th, 1920.

Acme Welding Co., Ltd.—Particulars of £10,000 debentures authorised August 30th, 1920, present issue £5,000; charged on the company's undertaking and property, present and future, including uncalled capital.

Walter Robb, Ltd.—Debentures dated September 6th, 1920, to secure all moneys due or to become due from company to Barclay's Bank, Ltd., charged on the company's undertaking and property, present and future, including uncalled capital.

CITY NOTES.

The Zurich Bank for Electrical Undertakings.

The report for 1919-20 of the directors of the Bank fur Elektrische Unternehmungen, of Zurich, whose scheme of reconstruction was outlined in this journal on September 3rd, states that despite existing difficulties, most of the undertakings in which the bank is interested were still sound internally. Many of them had been able to maintain their rate of dividend, while some were even able to increase the rate. As a consequence most of the investments, excepting the Russian undertakings, yielded acceptable results in the currency of the countries concerned, and the fruits of this serious work were only reduced through the necessity for converting into Swiss francs the receipts devolving on the bank. After giving the customary lengthy details concerning the investments, the report proceeds to give particulars of the losses through the depreciation of exchange, which have already been published, together with the scheme of reorganisation. The proposed reconstruction will leave the bank with a preference share capital of 94,500,000 fr., and ordinary shares for 18,750,000 fr., or a total of 113,250,000 fr. In this connection the directors state that a company with this amount of capital could utilise its entire existing organisation which has been carefully built up, and is in full operation, continue to carry on the existing undertakings, and associate itself with others, and obtain satisfactory results from new transactions. But above all, they could quietly await the improvement in the quotations for foreign currency without demands for interest and capital being constantly suspended over the bank like a Damocles sword.

German Companies.

The A.G. fur Elektrizitats Industrie, of Hamburg, reporting on the year 1919-20, states that the increase in the cost of materials had raised the prices of glow lamps tenfold, as compared with former peace prices. The net profits were 88,000 marks, as in 1918-19, and the dividend is at the rate of 7 per cent., as in the previous year.

The report of the *Brandenburg Carbid und Elektrizitats Werke A.G., of Berlin*, states that it was impossible for the Steinbusch works to resume the production of carbide in 1919-20 as it was first compelled to fill the contracts for the supply of energy. After making provision for depreciation, the accounts show net profits of 325,000 marks, as against 322,000 marks in 1918-19, and a dividend at the rate of 7 per cent. is proposed, as in the preceding year. The report further states that it was only possible partly to maintain working at the Muhlthal works owing to the scarcity of raw materials since the seizure of possession of the province of Posen.

The accounts of the *Isaria Zähler Werke A.G., of Munich*, which meter manufacturing company is closely associated with the Brown-Boveri group, show net profits and balance forward amounting to 1,778,000 marks for 1919-20, as compared with

743,000 marks in the previous year, depreciation having previously absorbed 605,000 marks and 127,000 marks in the two years respectively. It is proposed to pay a dividend and bonus of 40 per cent. on share capital of 2,750,000 marks, as against 15 per cent. in 1918-19. The report attributes the favourable results chiefly to the export business, although since the economic change the future is regarded with concern, despite the good stock of orders. It is now intended to increase the share capital by 5,500,000 marks.

Victoria Falls & Transvaal Power Co., Ltd.—The report for 1919 shows that the revenue for power and lighting supply, rents and sundries, interest, and dividend declared in 1920 in respect of 1919 from Rand Mines Power Supply Co., Ltd., less cost of generation, distribution, power purchased, &c., was £773,626, and interest and registration fees amounted to £55,844, making £829,471. After providing for interest and premium on debentures £219,161, and for depreciation and income tax, &c., £394,489, there remains £175,626 as net profit for the year, plus £93,693 brought forward, leaving £269,319. Two dividends, each of 3 per cent., less income tax, on the preference shares were paid for the year, leaving a surplus of £185,321, and out of this surplus the directors in June, 1920, declared a dividend of 5 per cent., less income tax, on the ordinary shares for the year 1919, and as the preference shares are entitled to share *pro rata* with the ordinary shares in the surplus profits distributed until the preference shares have received a total dividend of 10 per cent. for the year in respect of which the distribution is made, they also declared at the same time a further and final dividend of 4 per cent., less income tax, on the preference shares in respect of 1919. These were paid in July, 1920, and absorbed £91,000, leaving £94,321 to be carried forward.

France.—The business done by the Electricité de l'Ouest Parisien (Ouest-Lumière) during the past financial year brought in 22,431,595 fr., and the net profits came to 497,468 fr. The whole of this amount has been carried forward to the current year's accounts, no dividend being distributed.

The net profit realised by the Energie Industrielle during the past financial year amounted to 1,169,103 fr., as against 1,008,362 fr. for the previous 12 months. The dividend remains at 10 fr. per share.

The receipts of the Energie Electrique du Littoral Méditerranéan during the past financial year amounted to 17,217,632 fr., against 15,014,218 in the previous year. Net profits came to 6,806,061 fr., out of which a dividend of 30 fr. per share is paid.

The gross profits of the Compagnie Pyrénéenne d'Energie Electrique during the past financial year amounted to 2,590,248 fr. After providing for amortisations, &c., 501,888 fr. was left, as against 585,615 fr. for 1918. The dividend has been fixed at 6 per cent.—*Reuter's Trade Service.*

Halifax & Bermudas Cable Co., Ltd.—For the year ended June, 1920, there is a credit balance of £32,787, compared with £26,628 for the previous year. Balance brought forward £30,063. There is deducted £11,254 expended on repairs; 6 per cent., free of tax, for the year is the total distribution; £48,595 is carried forward subject to E.P.D. The company's cable worked efficiently during the year except for two short periods when it was interrupted near Halifax and Bermuda respectively.

Direct West India Cable Co., Ltd.—The credit balance for the year ended June 30th is £17,748, against £14,074 for the previous year. Amount brought forward £94,145. Expended on repairs £1,856; special interim dividend of £1 5s. per share capitalised in September, 1919 (making the shares fully paid); dividends 6 per cent., free of tax; £91,437 carried forward subject to E.P.D. The company's cable was interrupted for a few days near Jamaica. The insulation of the Bermudas-Turks Island section remains very low.

Stock Exchange Notice.—The Committee has specially allowed dealing in the following under Temporary Regulation 4 (3):—

Brush Electrical Engineering Co.—248,075 new ordinary shares of £1 each, 5s. paid, Nos. 210,489 to 458,563.

Company struck off the Register.—The following, it is officially announced, has been struck off the register and is dissolved:—

Autolectric Transmission, Ltd.

British Aluminium Co., Ltd.—Dividend at the rate of 8 per cent. per annum, less tax, on the ordinary shares for half-year ended June.

Dumbarton Burgh & County Tramways Co.—Dividend on the ordinary shares at the rate of 5 per cent., less tax, carrying forward £1,276.

Midland Electric Corporation for Power Distribution, Ltd.—Interim dividend at the rate of 8 per cent. per annum on the ordinary shares for the half-year ended June.

Oxford Electric Co., Ltd.—Interim dividend of 5 per cent. per annum on the ordinary shares for the half-year.

Stothert & Pitt, Ltd.—Total distribution for the year on the ordinary shares 12½ per cent., free of tax.

Eastern Extension, &c., Telegraph Co., Ltd.—Interim dividend for the quarter ended June 5s. per share, free of tax.

Guildford Electricity Supply Co., Ltd.—An extraordinary general meeting is called for October 7th, for the purpose of confirming a resolution already passed agreeing to the sale to the Corporation of the company's undertaking and assets (other than cash, book debts, and stock of coal, oil, waste, and maintenance materials) for not less than £55,000.

The American Westinghouse Co.—The shareholders of the Westinghouse Electric and Manufacturing Co. are to be asked to approve the issue of notes to the value of 30,000,000 dollars, and an increase of capital from 75,000,000 dollars to 125,000,000 dollars, in order to reduce the current liabilities of the company.—*Reuter's Trade Service, New York.*

J. Stone & Co., Ltd.—For 1919 the balance to credit of profit and loss account after allowing for depreciation, &c., was £162,253, plus £131,861 brought forward. It is proposed to pay a dividend of 10 per cent. per annum, and a bonus of 2s. per share on the ordinary shares, carrying forward £199,074.

Shawinigan Water & Power Co.—Dividend of 1¾ per cent. on the common stock for the quarter ended September.

STOCKS AND SHARES.

Tuesday Evening.

With every day bringing its own development of crisis in the industrial world, Stock Exchange markets are somewhat hesitating. It cannot be said that they are depressed, nor that business is absent, but what happens is that activity comes in spasms, and there is little definite lead noticeable in any of the markets. Besides the miners' dispute, markets are disturbed by the rates of exchange from New York and Paris, both of which exert an unsettling influence. Nevertheless, the Stock Exchange pursues a tolerably even keel having regard to all things, and even where members admit that they are not paying their expenses, they console themselves with the reflection that the losses are not so much as they might be.

The feature this week, so far as concerns the markets upon which we touch, is the rise in Underground Electric issues, and more particularly in the 6 per cent. income bonds of the company. It has been pointed out here, with monotonous iteration, that the traffics handled by the company are so enormous as to render it practically certain that as soon as rates were increased, by however little, this would probably make the difference between loss and profit. With increased fares coming into operation at the end of this week, anticipation has suddenly appreciated the difference upon which we have been dwelling for the last two or three months. In the middle of July, the income bonds were down to 53, and to-day they stand at 68½, having risen eleven points in the course of the week. The shares have participated in the improvement, and at 2¼ the ordinary are 12s. 6d. up, while the shilling shares advanced to 6s. 6d. There has been some speculative inquiry for the profit-sharing certificates standing now in the neighbourhood of sixpence. Central Londons have not moved.

Metropolitans and Districts, the latter particularly, are sharing in the more optimistic feeling which prevails in regard to Undergrounds. Districts have gone up 2¼ to 17½. Elsewhere, London Electric ordinary rose to 2¼. No changes worth mentioning have occurred in the prior-charge stocks of the companies. In fact, Metropolitan 3½ per cent. "A" debenture has fallen to 51½, business being marked as low as 50½ within the past few days.

The actual settlement of the electricians' difficulties led to further recovery in Edisons, lifting the price to a guinea, and other manufacturing shares are a trifle harder, although the improvement is scarcely reflected in the movements of prices. The companies are, of course, so closely connected with the coal trade that it is natural enough for quotations to be uncertain owing to the miners' strike threat. Moreover, the factor remains, and must continue, to operate for some time to come, of difficulties in the way of financing business at the present time. It is expected that the autumn will be surmounted without recourse to an 8 per cent. Bank Rate. Nevertheless, the banks are keeping a very tight hold over financial facilities, as most people know who are engaged in way of business.

While favourable accounts continue to reach this country in regard to the settlement of Mexico, definite assurances are not strong enough to induce any fresh volume of demands for the various stocks and shares. Consequently, there has been something of a lull in the rise which started a fortnight ago in most Mexican descriptions, and the market is in a condition of suspended animation. Amongst dollar securities, the movements have been somewhat irregular, and a few of the big rises chronicled here lately have been partially lost. Quotations are swayed, of course, by the varying rates of exchange from day to day, but there is a pretty general agreement that unless production is greatly increased in this country and within the near future, it is impossible to look for any substantial recovery in the pound sterling (as measured by the dollar) for some time to come. Rio Tramways first bonds are 89½ and the seconds 63. Shawinigan common at 133 are ex dividend and Kaministiqua common 111½.

Commercial Cable 4 per cent. debenture stock has retired 12 points to 67½, on the company ceasing to be a buyer at 80.

We ventured to point out at the time this offer of 80 was made that shareholders should on no account neglect to take advantage of it, so that this week's drop of 12 merely points to the argument set out in these columns previously.

Various electricity supply shares are now quoted ex the interim dividends, and this without affecting prices. City of London and Countys, South Londons and Chelseas are all xd., but the market continues in a comatose condition. The settlement of the electricians' dispute had no influence upon this section, where there is, in fact, nothing going on.

Cable companies are showing good results, the Direct West India announcing a net profit of £17,748, an advance of £3,700, while the Halifax and Bermudas credit of £32,800 is £6,000 better than that of a year ago. Eastern Extension declares an interim dividend of 5s. per share free of tax. Globe ordinary at 14⅛ are ex dividend. Anglo-American preferred fell 1 to 77½. Marconis are a better market at 2⅛, and Canadian Marconis stiffened to 10s. 6d. buyers. Henleys eased off to 1⅛.

Engineering shares are a good market, and Babcock at 2⅜ show 1/16 rise. Vickers have been fluctuating between 22s. 9d. and 23s. 9d., being nearer the former figure at the moment. But iron and steel shares are not bad as a whole. Philosophy in the Stock Exchange shrugs its shoulder and contends that if a coal strike spells revolution, all existing ideas of value and security will go for naught. If, per contra, the trouble blows over, the result can be counted upon to increase output and production, thus stimulating trade. With security itself becoming a subject for serious speculation, manifestly we do live in stirring times. Rubber shares—reverting from the general to the particular—are weak on the drop in the price of rubber below one and sixpence per lb. This has caused renewed anxiety amongst shareholders, who cannot yet foresee the full extent to which the produce may decline.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1918.	Dividend 1919.	Price Sep. 21, 1920.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary..	8	12	8½	—	£9 12 0
Charing Cross Ordinary	4	7	8⅛	—	10 16 6
do. do. do 4½ Pref. ..	4½	4½	2⅜	—	8 8 8
Chelsea..	3	4	3⅞xd	+ ¼	7 12 5
City of London	8	10	14xd	—	8 17 10
do. do. 6 per cent. Pref. ..	6	6	17/6xd	—	6 17 2
County of London	7	8	7⅞xd	—	10 17 0
do do. 6 per cent. Pref.	6	6	8xd	—	7 7 8
Kensington Ordinary	6	7	8⅝	—	9 0 6
London Electric	Nil	2½	1½	—	6 0 0
do. do. 6 per cent. Pref...	6	6	3	—	10 0 0
Metropolitan..	5	6	3⅝	—	11 8 6
do. 4½ per cent. Pref. ..	4½	4½	3⅛	—	8 0 0
St. James' and Pall Mall	10	12	6⅝	—	9 1 2
South London	5	6	3xd	—	10 1 8
South Metropolitan Pref.	7	7	17/-	—	8 4 8
Westminster Ordinary	8	10	5	—	10 0 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	77½	—1	7 14 10
do. Def.	88/6	1½	17⅜	—	8 18 10
Chile Telephone	6	6	5⅞	—	*5 4 4
Cuba Sub. Ord.	7	7	7⅜	—	*9 6 8
Eastern Extension	8	10	14⅝	—	*3 14 4
Eastern Tel. Ord.	8	10	149½	—	*8 14 4
Globe Tel. and T. Ord.	8	10	14xd	—	*3 16 9
do. do. Pref.	6	6	8xd	+ ¼	7 1 2
Great Northern Tel.	22	22	20	—	11 0 0
Indo-European	18	18	80	—	8 6 8
Marconi	25	25	2⅛	+ ⅛	9 1 10
Oriental Telephone Ord.	10	12	2½	—	*4 16 0
United R. Plate Tel.	8	8	6⅝	—	*6 1 0
West India and Panama	1/3	Nil	½	—	Nil
Western Telegraph..	8	10	14⅛	—	*6 14 4
Home Rails.					
Central London Ord. Assented ..	4	4	41½	—	9 12 10
Metropolitan	1	1½	21⅛	+ 1⅛	6 16 3
do. District	Nil	Nil	17⅛	+ 2½	Nil
Underground Electric Ordinary..	Nil	Nil	9½	+ 13/6	Nil
do. do. "A" ..	Nil	Nil	6.6	+ 1/6	Nil
do. do. Income ..	5	4	68½	+ 11	—
Foreign Trams, &c.					
Anglo-Arg. Trams First Pref. ..	Nil	5½	8½	—	8 9 2
do. do. 2nd Pref. ..	Nil	Nil	3½	—	Nil
do. do. 5 Deb. ..	5	5	67	— ½	8 15 6
Brazil Tractions	Nil	Nil	47	— ½	Nil
Bombay Electric Pref.	6	6	13½	—	4 10 7
British Columbia Elec. Rly. Pfce.	5	5	52½	—	9 10 6
do. do. Preferrred	2½	5	48¾	—	*7 4 4
do. do. Deferred	Nil	3	45⅞	— 2	*7 10 4
do. do. Deb. ..	4½	4½	58½xd	—	7 19 0
Mexico Trams 5 per cent. Bonds..	Nil	Nil	45	—	Nil
do. 6 per cent. Bonds..	Nil	Nil	35	—	Nil
Mexican Light Common	Nil	Nil	16	—	Nil
do. Pref.	Nil	Nil	27½	—	Nil
do. 1st Bonds	Nil	Nil	68	+ 1	Nil
Manufacturing Companies.					
Babcock & Wilcox	15	15	23	+ ⅛	*3 6 4
British Aluminium Ord.	10	10	1⅜	—	10 0 0
British Insulated Ord.	12½	15	1⅞	—	8 5 6
Callenders	25	15	1½	—	11 8 6
,, 6½ Pref.	6½	6½	18/-	—	7 4 5
Castner-Kellner	20	17	8	—	5 13 4
Crompton Ord.	10	10	17/6	—	11 8 6
Edison-Swan, "A"	10	10	21/-	+1/-	9 10 6
do. do. 5 per cent. Deb. ..	5	5	78½	—	6 5 9
Electric Construction	10	10	10/3	—	10 19 2
Gen. Elec. Pref.	6½	6½	18/6	—	7 9 5
do. Ord.	10	10	28/-	+6d.	*7 2 10
Henley	25	15	1⅜	— ½	9 4 8
do. 4½ Pref..	4½	4½	3⅛	—	7 4 6
India-Rubber..	10	10	1½	—	*3 0 0
Met.-Vickers Pref.	—	8	2⅜	—	7 6 2
Siemens Ord...	10	10	24/6	—	*3 5 8
Telegraph Con, ...	20	20	20	—	*6 0 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, September 21st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	2/5	...
a Ammoniac Sal	per ton	£100	...
a Ammonia, Muriate (large crystal)	,,	£92	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£41	...
a Copper Sulphate	,,	£42	...
a Potash, Chlorate	per lb.	1/-	...
a ,, Perchlorate	,,	1/8	...
a Shellac	per cwt.	£32 10s.	30s. dec.
a Sulphate of Magnesia	per ton	£18	...
a Sulphur, Sublimed Flowers ...	,,	£25	£3 dec.
a ,, Lump	,,	£22	£3 dec.
a Soda, Chlorate	per lb.	6d.	...
a ,, Crystals	per ton	£12	...
a Sodium Bichromate, casks ...	per lb.	...	...
METALS, &c.			
g Babbitt's Metal Ingots	per ton	£118 to £345	...
c Brass (rolled metal 2" to 12" basis)	per lb.	1/8½	...
c ,, Tubes (solid drawn)... ...	,,	1/6½ to 1/6½	...
c ,, Wire, basis	,,	1/4½	...
c Copper Tubes (solid drawn) ...	,,	1/9½	½d. inc.
g ,, Bars (best selected) ...	per ton	£168	£2 inc.
g ,, Sheet	,,	£168	£2 inc.
g ,, Rod	,,	£168	£2 inc.
d ,, (Electrolytic) Bars ...	,,	£118	£1 inc.
d ,, ,, Sheets ...	,,	£158	...
d ,, ,, Wire Rods..	,,	£134	£1 inc.
d ,, ,, H.C. Wire ..	per lb.	1/4½	½d. inc.
f Ebonite Rod	,,	3/6	...
f ,, Sheet	,,	3/-	...
n German Silver Wire	,,	3/-	...
h Gutta-percha, fine	,,	14/-	...
h India-rubber, Para fine	,,	1/8	½d. dec.
i Iron Pig (Cleveland Warrants) ...	per ton	Nom.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£59	...
g Lead, English Pig	,,	£37 10s.	10s. dec.
g Mercury	per bot.	£18 10s.	20s. to 30s. dec.
e Mica (in original cases) small ...	per lb.	6d. to 4/6	...
e ,, ,, ,, medium ..	,,	5/- to 10/-	...
g ,, ,, ,, large ...	,,	12/6 to 25/- & up	...
g Phosphor Bronze, plain castings	,,	1/6 to 1/11	...
g ,, ,, rolled bars and rods	,,	2/2 to 2/6	...
d ,, ,, rolled strip & sheet	,,	2/3 to 2/9	...
r Silicium Bronze Wire	per lb.	2/-	...
g Steel, Magnet, in bars	,,	1/8	...
n Tin, Block (English)	per ton	£269 10s.	£4 10/£5 10 inc.
e ,, Wire, Nos. 1 to 16	per lb.	4/9	...
White Anti-friction Metals ...	per ton	£80 to £335	...

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Ships' Fittings: Standard Specifications.—It will be remembered that the Institution of Electrical Engineers, at the request of the Ship Electrical Equipment Committee of the Institution, invited the British Engineering Standards Association to prepare a number of B.S. specifications, including one for watertight cable glands and one for watertight fittings for incandescent electric lamps for use on ships. As a result the following specifications have just been issued: B.S.S. No. 94, 1910—Watertight glands for electric cables, and B.S.S. No. 97, 1910—Watertight fittings for incandescent electric lamps. Watertight glands for use on deck, in bulkheads, and in cast metal and sheet metal boxes have been standardised; with the exception of the largest size, British standard conduit threads are employed, and the glands standardised are of simple form, six sizes in each case being provided (see B.S.S. No. 94, 1920).

Two types of watertight lighting fitting, namely, one of the bulkhead or "oyster" pattern, and the other convertible into a short or long pendant or into a bracket, have been standardised. Two sizes of each type are included, *i.e.*, one size suitable for metal-filament vacuum lamps up to 30 watts, and carbon-filament vacuum lamps up to 60 watts at pressures up to 125 volts; the other for metal-filament vacuum lamps up to 60 watts, and carbon-filament lamps up to 120 watts at pressures up to 250 volts. It is considered that the four fittings cover the whole range of requirements for this class of fitting, and that these standards will be suitable for use on shore as well as on ships. Whilst the standard specification only fixes the dimensions necessary to secure interchangeability of the parts likely to be broken or injured, these dimensions in effect practically settle the design of the fitting. This question was carefully considered, and it was decided that it was not in any way detrimental to the interests of either manufacturers or users (see B.S.S. No. 97, 1920). Copies of the specifications, price 1s. 2d., post free, are obtainable from the offices of the B.E.S.A., at 28, Victoria Street, London, S.W. 1.

MODERN MARINE PROBLEMS.

By C. V. DRYSDALE, O.B.E., D.Sc., M.I.E.E.

(*Abstract of the Eleventh Kelvin Lecture delivered before the* Institution of Electrical Engineers.)

(*Continued from page* 382.)

III. Navigational Application.

One of the most fortunate circumstances resulting from the large amount of research undertaken for war purposes is that the majority of the information and devices so evolved have the most important application to peace-time navigation.

The three chief desiderata for the safety and regularity of navigation appear to be as follows, in the order of their importance: (1) Ability to find and enter a harbour in foggy weather. (2) Location of position in sea during fogs. (3) Detection and location of ships and obstacles in darkness and fog. These three requirements can now respectively be met to a considerable extent by the following devices: (*a*) Leader gear, (*b*) sound ranging and directional wireless, (*c*) echo detection.

Leader gear, which promises soon to come into considerable practical use, consists of laying down a cable on the bottom along the track which it is desired to follow, and supplying it with alternating current of either sonic or infra-sonic frequency. By the use of suitable coils or electrodes attached to the ship the electromagnetic induction or the return currents in the water can be made to give signals in telephones or other devices by which the course of the cable may be followed.

Attempts were first made in this direction in the St. Lawrence River by Prof. R. S. Owen as early as 1903, but were only partially successful. During the war the idea was revived by Capt. Manson, employing search coils and amplifiers, and successful results were immediately obtained. Two coils about 4 ft. square are fixed on the sides of the ship a short distance away from the ironwork, and are connected to a

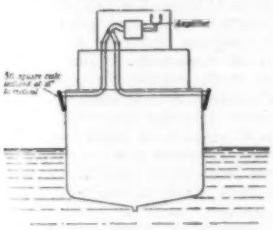

Fig. 7.—Aural Leader Gear.

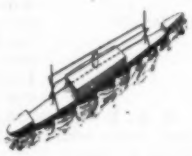

Fig. 8.—Visual Leader Gear

change-over switch and three-valve amplifier and telephones. The cable is supplied with A.C. of a frequency of about 500 cycles per second, and this current is cut up into signals by an automatic interrupter. Steering is effected by listening on the two coils alternately, the signals being stronger on the side of the ship nearer to the cable. The difference in intensity is apparently due to the screening action of the iron hull, and varies with the size of the ship, but it is usually possible to find positions for the coils which give good indications. Fig. 7 is a diagram of the arrangements.* In order to avoid the necessity for listening to telephones, the author has attempted the employment of tuned alternating relays to operate lamps on the navigating bridge of the ship, and thus to give continuous visual indications. For this purpose two inclined coils of a few turns are fixed in the rigging as shown in fig. 8. If the lines of magnetic force are in circles round the cable as generally supposed (fig. 9 (*a*) shows circular field distribution and E.M.F. in sloping visual leader gear coils; (*b*) shows field distortion due to sea water), the E.M.F.'s induced in the two coils should be equal when the ship is vertically over the cable, but when it is on one or other side the E.M.F. in the coil pointing more nearly towards the cable will be the higher. At a certain lateral distance from the cable the plane of one of the coils will be tangential to the lines of force, and will consequently have no E.M.F. induced in it. Fig. 10 shows the construction of the A.C. relay employed in conjunction with this device. It is on the same principle as the author's vibration galvanometer, in which a pivoted or suspended iron needle vibrates in the field of a horseshoe magnet, and can be tuned by varying the intensity of the magnetic field. This needle is enclosed in a simple coil carrying the A.C., and is provided with an arm carrying a rounded platinum end which makes contact with two fine tangential platinum wires when it vibrates. As the contact is intermittent, it is found desirable to convert it into a continuous contact by the simple device of passing the local current from the vibrating contacts through the coil of an ordinary heavily-damped moving-coil relay, the contact arm of which slides between two sets of parallel platinum-wire brushes so that when the coil is deflected, and oscillates owing to the intermittency of the current, it maintains a continuous rubbing contact against the brushes. The two relays are combined in a single magnet as shown, and the tuning is very simply effected by traversing the whole of the A.C. system along the axis of the magnet by means of a screw, so as to be in a stronger or weaker magnetic field.

It is fairly easy to set the contacts of this relay to work with a power consumption of 0.01 microwatt or less, which is amply sufficient to enable it to switch on a glow lamp at ¾ mile from a cable carrying only 5 amperes of A.C. in a depth of water of 20 fathoms.

A relay on a similar principle was devised by Mr. Sidney Evershed as far back as 1896, but was unknown to the lecturer at the time. Mr. Evershed went much further and designed a vibrating-wire relay which operated with only 0.0001 microwatt, but it is desirable to have a fairly robust instrument for use on shipboard, and it is necessary that the relay should be fairly definitely metrical in its operation for the present purpose.

The tuning of this relay is fairly sharp, and this requires the frequency of the current supplied to the cable to be maintained constant within about ¼ per cent. of its nominal

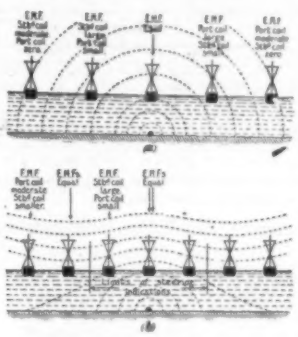

Fig. 9.—Field Distribution.

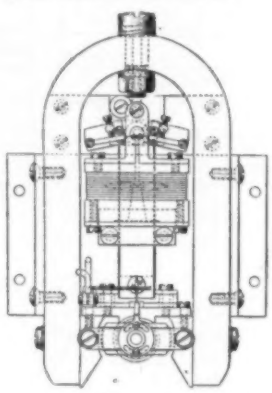

Fig. 10.—A.C. Relay.

frequency, but this has the attendant advantage that different cables can be used with different frequencies without mutual interference. For example, in wide estuaries like the Mersey and the Clyde, where there is a considerable amount of cross traffic, it is asily possible for the main and cross routes to be worked quite independently by using different frequencies.

In order to keep absorption and distortion of the electromagnetic field as small as possible, frequencies of between 10 and 20 cycles per second are used with this device, and this makes the presence of the cable almost undetectable unless the frequency is known.

When this device was first experimented with it was found practically impossible to get definite port and starboard indications for steering purposes, and it was, therefore, found necessary to investigate the distribution of the magnetic field, by observing the E.M.F.'s induced in the two inclined leader-gear coils, with the result of finding that even at these low frequencies it was greatly distorted. Fig. 11 shows the distribution determined in the case of a cable in about 100 ft. depth of water with a frequency of 15 cycles per second; E.M.F. induced in ships' coils with spreaders 20 ft. long. Vibration galvanometer 500 in series. Sensitiveness, 3.43 cm. per millivolt. Vessel crossing west to east, heading south. Current in cable 6 amps. Frequency, 15 cycles per second. Depth, 16-17 fathoms at cable. At the points A and B where the lines of force should be nearly vertical according to the ordinary theory, they are actually horizontal, so that instead of one relay being out of operation both are equally affected, and there can be no port or starboard indication. At greater distances from the cable the magnetic field actually bends upwards again, so that the indications are reversed. In order to avoid ambiguity, therefore, it is necessary to limit the sensitiveness of the relays so that they only operate with an E.M.F. above its value at the points of inflection and the steering indications must be limited to a range of 60-70 yards on either side of the cable, as shown in fig. 9 (*b*), which is ample, however, for navigating a narrow channel. In order to give even sharper indication of the position of the cable, a pointer indicator on the ohmmeter principle may be used, which is actuated by the contacts of the A.C. relays. When the two relays are vibrating equally, the average value of the intermittent current from the contacts of each is the same, and the needle points directly down to the cable, but if the

* Elec. Rev., Sept. 3rd, 1920.

ship is on one side and the electromotive forces in the coil are unequal, the average duration of contact in one relay is greater than in the other, and the pointer goes over to the side on which the cable lies.

A triple A.C. relay set is used, two of the relays actuating the port and starboard red and green lamps, while the centre relay is set to maximum sensitiveness, and switches on a white "approach" lamp, indicating the first approach to the cable at a distance of ½ to ¾ mile. After this lamp lights, the ship keeps on the same course until the red and green lights glow, and then steers along the cable by the latter.

In the early experiments with this device the frequency was hand-regulated by means of a simple stroboscopic device, in which a Neon tube illuminated from the contact of a standard tuning-fork was used in connection with a geometrical disk on the rotary-converter shaft. In order to avoid the necessity for hand regulation a simple automatic speed controller has been devised. A small magneto generator of the type used for electrical tachometers is attached to the shaft of the alternator, and its E.M.F. is balanced against a few secondary cells through a sensitive moving-coil relay. Exact balance of E.M.F. for speed required is obtained either by rotating the brushes of the magneto by screw gear or by shunting the generator with a variable resistance. When the speed rises or falls the relay switches on one or other of two pairs of

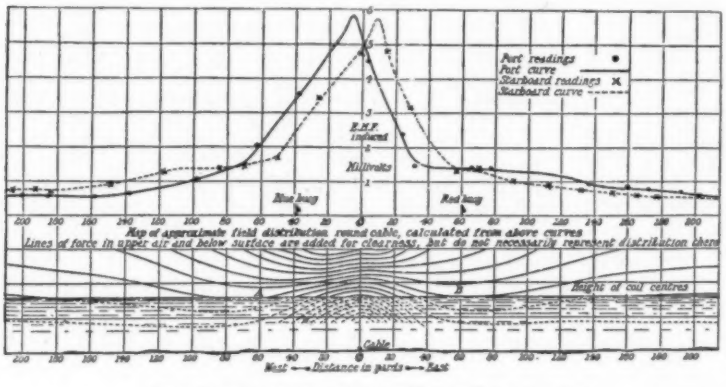
Port readings
Port curve
Starboard readings
Starboard curve
R.M.F. induced
Millivolts
Blue buoy
Red buoy
Map of approximate field distribution round cable, calculated from above curves
Lines of force in upper air and below surface are added for clearness, but do not necessarily represent distribution there
Depths of coil centres
Cable
West ← Distance in yards → East

Fig. 11.—Submerged Cable Field Distribution.

electromagnets actuating a rocking arm which actuates a reversing switch in the armature circuit of a small motor, causing it to run in one or other direction and to traverse the contact of a rheostat in the field circuit of the main rotary converter or driving motor. When the speed is correct and the rocking arm is horizontal, the armature of the small motor is short-circuited by two springs so that it pulls up suddenly preventing over-running, while if the supply voltage varies so greatly as to traverse the contact near to its limits, an electric bell is rung which calls attention to the need for adjustment. This device appears to control the frequency to within 0.1 or 0.2 per cent. of its nominal value, which is amply sufficient for the leader gear.

It is easily possible to operate both the aural and visual systems of indication simultaneously on the same ship and with the same cable. For this purpose the cable is supplied from a high-frequency and a low-frequency alternator in series as shown in fig. 12. The inductance of the low-frequency machine is sufficient to choke down the high-frequency current almost completely, but by connecting a 20-M.F.D. condenser in series with the automatic signalling key across the armature of the low-frequency machine, the interrupted high-frequency supply can be maintained without affecting the low-frequency supply. It is, therefore, possible for ships to use either the aural or the visual indicating systems with the same cable, or to combine both indicating arrangements on the same ship without mutual interference.

Acoustic methods may be employed with great utility in conjunction with leader gear by having a sounding device at the end of the leader cable, enabling the ship to steer towards the end of the cable from a distance of 10 miles or more.

Although leader gear promises to be of great service for guiding ships into and along harbours, it is impossible to apply it generally for navigation in the open sea. It is desirable to have some means whereby a ship in a fog can easily ascertain or be given its position, and thus avoid dangers, or be guided towards a leader cable. This may be done by directional wireless.

Another method is by means of submarine sound ranging. If a sudden impulse such as an explosion is produced at a given point the disturbance spreads out in all directions, and can be received on three or more fixed hydrophones or shock receivers. If the explosion takes place at the centre of a circle passing through them, the impulse should reach all the receivers simultaneously, but if it emanates from any other position it arrives at different times, and if these time differences can be accurately determined and the velocity of propagation is known, the position of the source can be calculated. This device, the introduction of which to marine service has been chiefly due to Prof. Bragg, and which has been developed by Capt. Boulding, has been of considerable service in the war for locating submarine explosions, apart from its well-known application for locating guns in land warfare; but it can obviously be equally applicable for locating ships if they drop depth charges or employ other methods such as the Thornton spark for producing strong submarine impulses.

Probably the most promising method of location would be by means of simultaneous wireless and sound impulses sent out at intervals from a fixed station. If the ship were provided with a wireless equipment and a hydrophone, either or both of them being directional, the direction of the source would be easily determinable, and its distance by the interval of time between the arrival of the two signals—nearly a mile for each second of interval. This may very likely prove to be far the most convenient and accurate method of location, and arrangements are being made for developing it.*

Improvements have been effected in the ordinary three-receiver sound-ranging method with the object of simplifying the observation and determination of the source. Up to the present the times of arrival have been obtained by means of hydrophones connected to separate strings of an Einthoven galvanometer, which involves a photographic record. Dr. A. B. Wood and Mr. Ford have greatly improved this process by their phonic chronometer, which enables the times to be read directly on dials to an accuracy of 1/1,000th second. The principle is analogous to that of the author's roller stroboscope, in which a wheel with stroboscopic slits rolls on a cone which is kept revolving at a constant speed by a phonic wheel motor actuated from a standard tuning-fork.

In the phonic chronometer a vertical cylinder is maintained in rotation in the same manner, and three small pivoted disks are arranged to be pressed in contact with it by differentially-wound electromagnets when the current through one winding is broken. When the second circuit is broken, the disk springs back from contact with the roller, and immediately touches against a brake which stops it instantly. The disks are provided with pointers registering the times of contact to 1/1,000th second, and with light gearing extending the total time to 10 seconds or more, so that the three time intervals can be directly read off on the three dials. Apart from its avlue for sound-ranging, this chronometer should have most valuable applications for gunnery and general testing, as it is remarkably compact and reliable in comparison with any high-speed chronometer hitherto devised.

Instead of ordinary microphones the hydrophones employed with this device have single-point contacts, which are broken by the arrival of the impulse, but which can be restored by the operator through the agency of a magnetising coil. Extremely sensitive receivers of this type have been devised by Mr. Burnside, who employs a hollow silver-plated iron ball to make contact with a point on the diaphragm. The ball is arranged to have perfectly neutral buoyancy in a liquid inside the receiver case, so that it has no gravity control, and it is attracted into contact with the disk by a small coil.

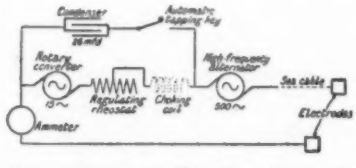

Fig. 12.—Connections for Combined Aural and Visual Leader Gear.

By means of these devices the time intervals for sound ranging can be read from the phonic chronometer immediately the impulse is received; the calculation of the position of the source is very troublesome, but by the aid of this chronometer and a locator it will probably be possible to determine the position of a source within a minute after the arrival of the impulse. Corrections have to be applied for the temperature of the water, which considerably affects the velocity of propagation, but these can easily be made by curves correcting the time differences observed to a standard temperature before setting them on the scales of the locator.

If a ship can locate its position in any weather, and guide itself to a harbour or through a channel in a fog, the only remaining danger is from obstacles such as icebergs, wrecks, and rocks. It appears probable that the echo methods of detection already described will eliminate this danger. Probably the most reliable arrangement will be a combination of

* "Scientific Signalling and Safety at Sea," by **Prof. J. Joly, F.R.S.**, *Philosophical Magazine*, July, 1918.

an acoustic device such as the Fessenden oscillator or Wrightson syren with high-frequency searching equipment.

Another device which may be of considerable service in navigation is the obtaining of soundings by echo methods from the bottom. This has already been carried out very successfully by M. Marti, who has obtained soundings in depths of from 60 to 160 metres to an accuracy of about a metre, from ships moving at speeds up to 10 knots, by the use of small explosive charges fired alongside the vessel. By this means valuable information about position may be obtained, and the approach to shoals or shores detected. The lecturer has recently devised a scheme for giving direct and continuous indication of the depth of water under a ship by a pointer indicator on the bridge.

A great deal of work has been done on submarine and aerial signalling, both secret and otherwise, with the object of permitting ships to communicate with one another, and thus avoid collisions. One of these devices which may be mentioned is the improved form of photophone invented by Dr. A. O. Rankine, and described before the Physical Society, in which a mirror is fixed on the lever of a phonograph diaphragm which forms an image of a bright illuminated grid on another similar grid. The amount of light transmitted varies with the vibration of the diaphragm, and is concentrated on a selenium cell at the distant station. Remarkably clear speech is obtained in this manner, and the device is easily adaptable to ordinary ship searchlights.

If all the above devices prove as successful as they appear to promise, it seems probable that before long the last remaining dangers will be eliminated from navigation, and that passages will be made without danger or delay in all weathers.

(To be concluded.)

ELECTRICITY IN THE GERMAN ARMY.

By Major T. Rich, O.B.E.

(Concluded from page 350.)

Sub-station and General High-pressure Accessories.—The accessories used were in most cases of a simple character. The ordinary small sub-station was equipped with disconnecting links, tubular fuses, choking coils, and horn lightning arresters, no oil switch being used. In earlier stations French apparatus was used, although in a number of instances the copper blades of links were replaced by iron. In later sub-stations links, fuses, and other apparatus were largely made of iron or zinc alloy; in the latest type zinc alloy was used. Choking coils were made of iron; this conforms to a generally accepted civilian practice.

Difficulty was apparently met with owing to the lack of glycerine to prevent the freezing of liquid resistances. At the time of the armistice efforts were beng made to avoid this by the use of dry carbon resistances, and alternatively the use of metallic resistance wire wound non-inductively and embedded in enamel. A few resistances were found with a metallic resistance wire wound with a shuttle through a textile webbing and immersed in oil.

High-pressure busbars and connections for sub-stations were usually made of iron wire about 5 mm. in diameter, and to take this wire a number of special insulators with special screwed cone connectors was found in Jeumont Dump. It might be noted that in the U.S.A. during the war, where current capacity allowed, iron pipe was largely used for high-pressure busbars, and owing to its rigidity and general convenience this system is being continued.

The corrugated or accordeon insulators seem to have been abandoned and replaced by cone-shaped insulators with one, two, or three rings under the cap. These were usually secured to sub-station ironwork by means of bolts screwed into plates cemented or plastered into the bases. Great care was taken in all sub-stations to earth the metallic bases of all fittings and apparatus. Earth plates were usually made of galvanised iron.

Sub-station Buildings.—The sub-stations used for the main 45,000-volt lines were in most cases arranged in existing buildings, so as to avoid the attentions of aircraft—for instance, at Wasquehal, near Lille, in a bleach works; at Jeumont, in a cable works; at Lagnicourt, in a barn. The sub-stations at Lille and Jeumont were apparently intended as almost permanent installations, as modern armoured concrete partitions and cubicles were used. Plain glass windows with holes in the centre were used on 45,000-volt circuits instead of inlet insulators. Several temporary wooden sub-stations for 30,000 volts used for munition work were noted in the neighbourhood of Aix-la-Chapelle, in Germany. The sub-stations used for systems at 5,000 to 20,000 volts were in most cases made of squared framing, rough forest boarding, and covered with bitumen paper. Inlet insulators, panes of glass, or rectangular openings were used as conductor inlets. Sub-stations were frequently arranged on the roof or against the eaves of outhouses and farm buildings, or in the buildings of sawmills and depots. Channel iron was largely used when steel framing was necessary. Transformers were usually placed on wood floors without the use of concrete. Judging by the way in which transformer posts at 11,000 volts were placed in wooden cubicles in sawmills, the "Starkstrom" officers must have had confidence in the reliability of the apparatus they were using.

Fig. 13.—Sub-station Attached to Farmhouse.

Fig. 14.—Sub-station at a Sawmill.

Portable Transformer Stations.—In order to be able to supply light or power to mobile corps or divisional headquarters, or to semi-mobile workshops, a number of portable transformer stations were used. The earliest of these were of the type made by electrical manufacturers and used before the war in the Harz and other districts to run chaff cutters, thrashing machines, and other plant for farmers. The later types were improvised locally out of lorries, vans, and farm wagons. Besides transformers, they were fitted with section links, fuses, low-pressure switches, fuses, and sometimes with lightning dischargers and choking coils. Some of the wagons were fitted with low-pressure, 3-phase motors. It is estimated that about 50 of these must have been used on the North-Western Front.

Connection was made to high-pressure lines through pass-through or line insulators on the roofs, and bolted or spring clips. An earth plate and earth connection were used to protect the apparatus. These transformer stations were used for voltages up to 15,000-16,000 volts and capacity of 20 to 30

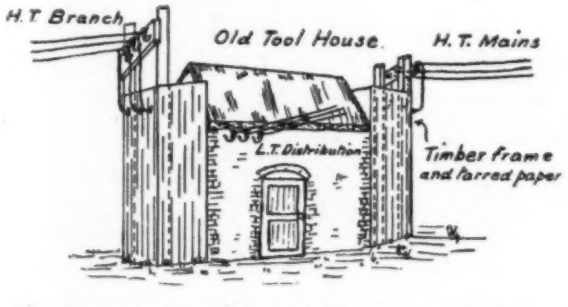

Fig. 12.—Transformer and Switching Station near La Bassee.

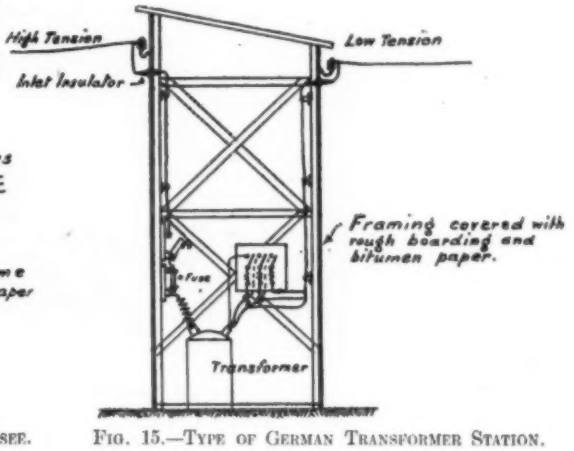

Fig. 15.—Type of German Transformer Station.

K.V.A., and according to a prisoner, were very useful and successful.

Fig. 16 shows an improvised transformer station of this kind.

Switchgear.—The high-pressure switchgear used was to a large extent that requisitioned from the French. Several sets of 3-phase switchgear for 45,000-60,000 volts were found after the advance. The peculiarity of these, and of a number of 22,000-volt switches lay in the fact that the solenoids and armatures operating the trip gear were placed on the switch insulators, and operated the trips through insulated rods, the adjusting mechanism being accessible and earthed. This avoided the use of series-operating transformers. Information was received that somewhat similar switchgear had been supplied by a German firm to Spain operating at 70,000-80,000 volts shortly before the war.

It is evident that efforts were made to reduce the apparatus required for high and low-pressure work to an absolute minimum, not merely to save expense and man power, but also to avoid complications, the necessity for extra-skilled operators, and the extra liability to accidents which sometimes accompanies the excessive use of safety apparatus.

Comparatively few instruments were found, and only very few of German war-time manufacture.

The low-pressure motor starting and other switchgear used was very simple; practically no enclosed knife switches were used on 110/190-volt, 3-phase circuits, and a material quantity of the more complicated low-pressure apparatus requisitioned from the French and Belgians was kept in store and not used. A number of iron switches were found, but some of these were in a rusty state.

Appended to the report are translations of a number of German Army Orders, relating to procedure in general with regard to the use of electric power, precautions to avoid risk of shock or damage, restrictions on the use of electricity for lighting and power, &c., the specified electrical detachment being always referred to as the responsible authority on such matters. The routine to be observed in sub-stations, &c., is prescribed in minute detail, as well as the procedure in connection with the maintenance and repair of 45,000- and 15,000-volt lines, and in bringing them into use after breakdown.

A German document found at Sin-le-noble, dated November 12th, 1917, and relating to electricity supply in the 6th Army, contains many interesting items, of which a selection follows. It will be noted that everything connected with electrotechnics is under the sole control of the electric power battalion :—

All electrical arrangements of the 6th Army will be installed and maintained by or placed under the supervision of the 6th Electric Power Battalion (Abteilung). Geographical and not economical conditions determine the dependence of the battalion on the 6th Army.

Camp Commandants are not entitled to undertake technical measures themselves, but should lend all assistance for the carrying out of such measures.

Malicious damage of H.T. systems occurs unfortunately very often. The offenders are almost without exception soldiers who are collecting and salving copper. These men scarcely ever bring to light copper which could otherwise have been lost to the Army, but destroy and rob systems which have been erected or put into working order for the benefit of the troops by the 6th Electric Power Battalion at considerable trouble and expense. By these occurrences, the troops are made to suffer very appreciably. In consequence of the lack of raw materials, destroyed systems cannot again be erected and consequently billets and occupied positions are without light; workshops, pumping stations, &c., without power. Very often offenders are killed by the electric current.

All building materials, machines, and apparatus necessary for erection of electric supply systems will be provided by the 6th Electric Power Battalion, either from dismantlements in the Army area or by purchase in the home market. Regimental troops may not either at their own expense or by means of dismantling in the Army area provide themselves with such materials. The obtaining of building materials from home is expensive, and, owing to lack of raw materials, very limited. The greatest economy is therefore necessary. In this respect it is again remarked that especially on economic grounds, any wilful damage, such as taking away or dismantling, by troops must be rigidly suppressed.

All electrical materials found in the Army area are placed at the disposal of the 6th Electric Power Battalion unless required by a higher authority. In this connection it is a matter of indifference whether materials are in use or not. The 6th Electric Power Battalion alone decides whether a system is in use or not. The battalion is thoroughly acquainted with every system existing in the Army area. In this way the salvage of copper from electrical stations is, generally speaking, impossible. Such salvage will usually be considered as pilfering, seeing that systems in the forward areas which cannot be kept running will be systematically salved by the 6th Electric Power Battalion.

The installation of a lamp will generally cost 20 marks; an electric motor 1,000 to 3,000 marks; an accumulator 20 to 80 marks. Those services which ask for electric installations should consider these costs.

Installations with heavy current consumptions should be arranged near transformers. For isolated single installations, with a high current consumption, the erection of an electrical system is no longer possible on account of the lack of raw material. . . . The 6th Electric Power Battalion has instructions to remove lamps in excess of the above numbers. Should the battalion in the execution of such removal be in any way hindered, it has instructions to report the respective obstructor to Headquarters Staff. It should be understood that, at a time when the home market is suffering from lack of material and coal, no resistance should be offered to the battalion in these matters.

The extent of power installations, as against light installations, cannot be beforehand determined. The stock of machines is very limited, the demand at home so great that it is absolutely necessary to set free machines in occupied territory in order to send them home so that the homeland shall be in a position to continue deliveries, especially of munitions, in sufficient quantities. It must, therefore, be assumed that no motor may be put into use without permission of the 6th Electric Power Battalion. The greatest economy must be maintained in the distribution of motors. Existing installations must be utilised to their fullest capacity, the actual working time of motors must be increased, and small installations combined together. The Army must, therefore, content itself with only the main units necessary for warfare. Home factories can deliver no more transformers. Each transformer must, therefore, be utilised to its fullest capacity.

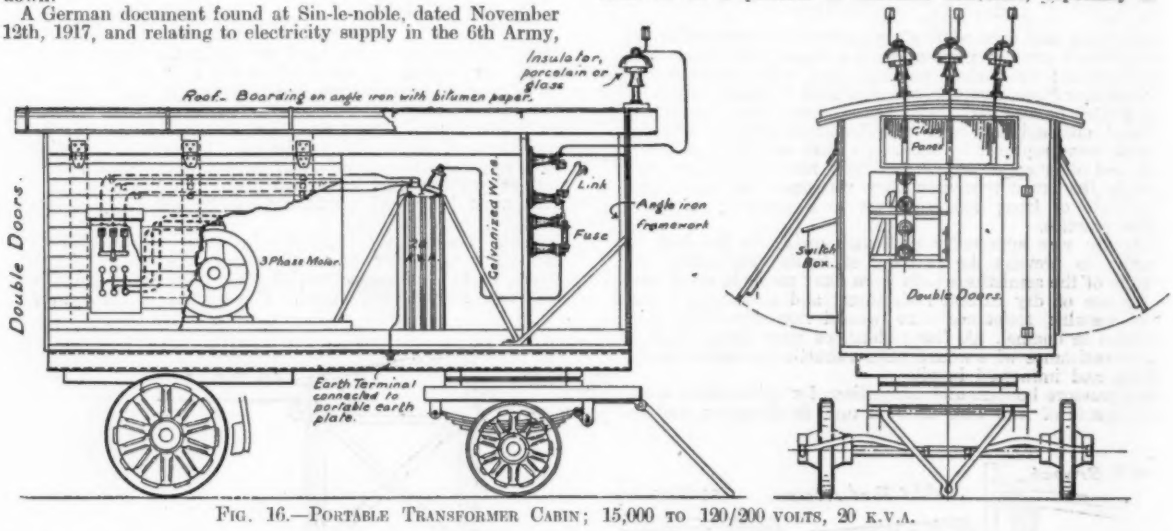

FIG. 16.—PORTABLE TRANSFORMER CABIN; 15,000 TO 120/200 VOLTS, 20 K.V.A.

Demands for erection of electrical installations forwarded through other than the above channels will only cause delay, as such demands must eventually go through the hands of the Electrical Battalion. Troops may not undertake work on their own account.

In order to ensure safety of the whole installation, on account of the lack of materials, and to save coal, the use of electric heaters is prohibited. The Electric Power Battalion has the right to make exceptions in very special cases. The connection of electric heaters to mains, without consent of the Electric Power Battalion, will be severely punished.

In the front line, where it is not possible to obtain connections to an overland central station, accumulator lighting, on a small scale, may be arranged. The 6th Electric Power Battalion runs its own accumulator factory. Here again very little material is available. Accumulator lighting must therefore be confined to only the most important services, and to as narrow a fighting area as possible.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

"Heatrae" Electric Fires.

A new line of electric fires has just been developed by Messrs. Electric Fires, Ltd., of King Street, Norwich, embodying many novel and interesting features. The heating element, which is normally loaded to 1,000 watts, consists of wire spirals supported only at intervals, as shown in fig. 1, by a series of separate porcelain insulators, in front of a highly polished metal reflector, so that, having no solid mass of material to heat up, it instantly glows red when switched on, and its effect is multiplied by the reflections of the hot spirals, not only in the element itself, but also in the adjacent polished metal parts of the heater. The construction

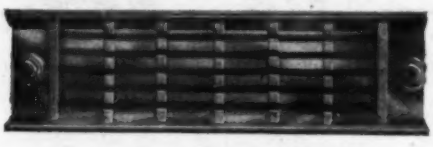

Fig. 1.—The "Heatrae" Fire Bar.

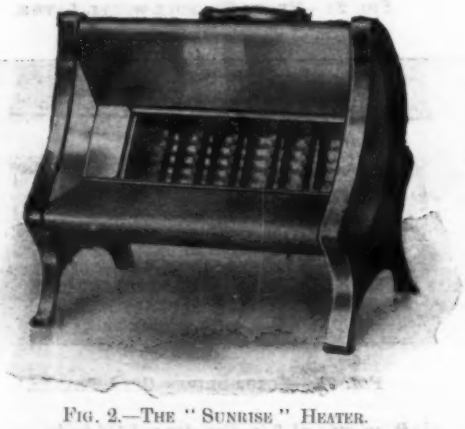

Fig. 2.—The "Sunrise" Heater.

Fig. 3.—The "Meridian III." Heater.

of the element is ingenious and extremely simple, all the parts being locked in position but readily removable, and the user can easily renew the winding without fear of mishap, the terminals being designed on a new principle, so as to be self-centring without bushing the holes through which they pass. The complete element is practically unbreakable, even under violent usage, and can be replaced *en bloc* with the greatest ease.

Equal attention has been given to the frames in which the elements are housed; we illustrate in fig. 2 the "Sunrise" heater with a single element, made of aluminium throughout, and weighing complete only 3¼ lb., so that it is portable in the highest degree. It will be noticed that the element is surrounded by polished surfaces, in each of which the glowing spirals are reflected, so that the maximum effect is produced, both in appearance and in the directing of the radiant heat towards the front, as we have personally verified. The clamping nuts are covered with neat aluminium slides, and the finish of the heater compares favourably with that of any that we have seen, British or foreign. Fig. 3, on the other hand, shows a cast-iron front, with sheet-steel body and trivet, which can be fitted either above or below the fire bars. This size takes 3,000 watts, and is fitted with three turn switches. Other sizes and patterns are made, with sheet metal fronts and aluminium reflectors, and loaded up to 4,000 watts, as well as a factory or cabin heater and a bowl fire. The handles are heat-insulated. All these fires are made in a new up-to-date factory on mass-production lines, with interchangeability of parts, and are guaranteed; they constitute a real innovation, combining artistic merit with sound design.

A Wireless Outfit for Small Vessels.

Among the many products in the field of wireless telegraphy manufactured by Messrs. Siemens Bros. & Co., of Woolwich, is the cabinet type station illustrated in fig. 4. This is suitable for installation in small vessels, yachts, &c., and the power required for charging the battery is about 300 watts, which can be taken from the ship's mains or supplied by a 0.3-kw. petrol engine-driven d.c. generator. The 50-volt battery for operating the transmitter is installed in the bottom left-hand compartment of the cabinet. The motor-generator consists of a d.c. motor driving a 500-cycle, 0.25-kw. generator. The excitation circuit consists of four specially insulated glass condensers, an inductance, and quenched spark gap. An aerial lengthening variometer is included permitting very accurate adjustment of the wave-length. An aural receiver with contact detector is employed. This receiver, which has a wave-range of from 200 to 2,000 metres, provides a wide range of variation of coupling, enabling very exact tuning to be obtained. A valve amplifier set can be fitted as an extra if required. The whole of this apparatus is included in a cabinet with hinged face, which can be completely closed when not in use. The overall dimensions of the cabinet are approximately as follows: Width, 5 ft.; depth (open), 2 ft. 10 in.; depth (closed), 1 ft. 10 in.; height, 4 ft. 8 in.

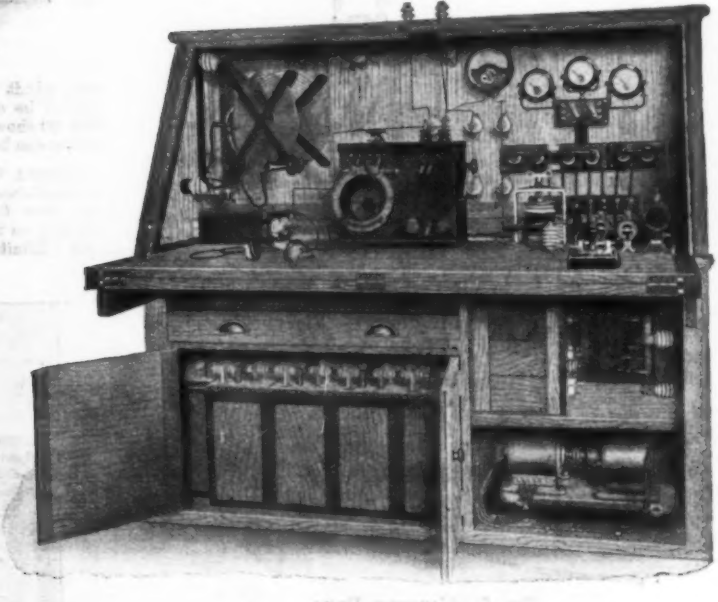

Fig. 4.—Ship's Wireless Cabinet (Open).

"Apex" Switch and Fuse Gear.

We have recently received from The Sun Electrical Co., Ltd., 118, and 120, Charing Cross Road, W.C. 2, details of some new switch fuse apparatus shortly to be placed upon the market. Fig. 5 illustrates the "Apex" watertight iron-clad switch fuses. The construction of these switches embodies an entirely new principle resulting in a simple action for switching "on" and "off." Each movement is of the "quick break" type, and is claimed to be entirely independent of the action of the operator. All contacts enter or leave

the clips at the same moment, reducing the possibility of arcing to a minimum. The switches are completely "fool-proof," and it is impossible to put the switch in while the cover is open or to open the cover while the switch is in the "on" position. Care has been taken in the design to permit

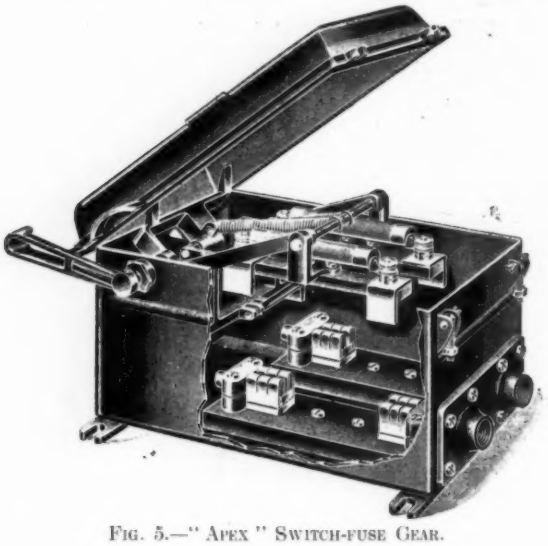

Fig. 5.—"Apex" Switch-fuse Gear.

speedy wiring and erection. This apparatus is being manufactured in London, and the sole selling rights, apart from the company's sales, have been vested in Messrs. Drake and Gorham Wholesale, Ltd., 67, Long Acre, W.C. 2, The Foster Engineering Co., Morden Road, Wimbledon, and Messrs. Downs & Davies, 1-3, Stanley Street, Liverpool.

A Magnetic Drill.

Among the products of Messrs. White, Jacoby & Co., Ltd., Balham Place, Camden Town, N.W. 1, is the magnetic

Fig. 6.—Magnetic Drill.

electric drill shown in fig. 6. The tool embodies all the features of the firm's standard electric drills, but has in addition a powerful electro-magnet for holding the drill up to its work. No pressure lever or other fixtures are necessary, and a considerable saving in time is effected thereby. A link is supplied with the drill to enable it to be suspended if required, as shown.

Electrically-wound Clocks.—An article in *L'Industrie Electrique* on the above subject describes a system due to Mr. M. Mayeur, in which the weight itself contains a small motor and gearing and climbs up the chain at intervals, the motor being started and stopped through the agency of external contacts corresponding to its limits of position.—*Technical Review.*

THE MACHINE-TOOL AND ENGINEERING EXHIBITION.

(*Continued from page* 364.)

Messrs. Tangyes, Ltd., Birmingham, show in operation two electrically-driven machines. One is an axle-turning lathe, height of centres 12 in., which admits between centres 108 in., and on which both ends of a wheel axle may be machined simultaneously. The other is a centring and ending machine, which

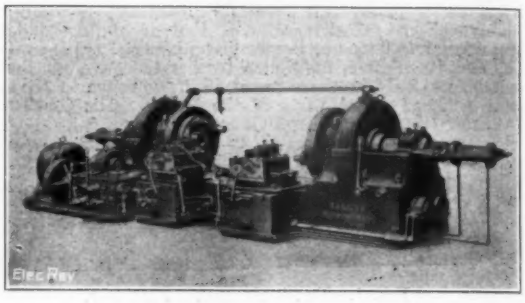

Fig. 20.—Heavy Tramcar-wheel Lathe.

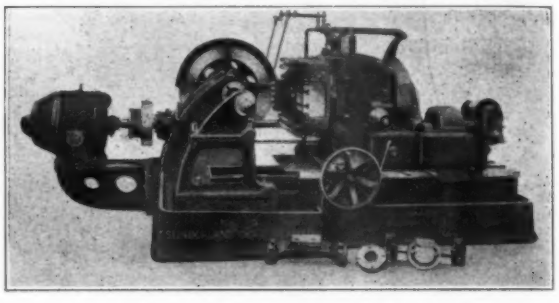

Fig. 21.—Motor-driven Gear Planer.

will admit an axle of 9 in. diameter and 114 in. in length, which should be of interest on account of its high rate of production. Fig. 20 shows a Tangye heavy tramcar-wheel lathe, and the driving motor can be seen at the left-hand side of the illustration.

Messrs. C. A. Hunton & Sons, London, are exhibiting a novel form of shearing machine, which is claimed to be an improvement on other forms of hand-operated machines. The firm is also putting on the market a rail saw machine which will be known as the "Limitax," and is showing for the first time a hack-saw

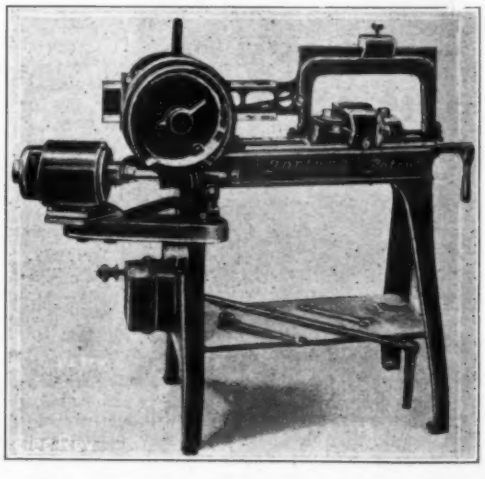

Fig. 22.—"Fortuna" Power Hack Saw.

machine to cut 8 in. by 8 in., which embodies all the advantages and improvements of the well-known "Fortuna" 6in. by 6 in. saw that is fitted with a universal vice, and is illustrated in fig. 22. The net weight of this machine is 280 lb., its shipping weight being approximately 504 lb., and the dimensions of its packing-case approximately 58 × 42 × 20 in.

Messrs. J. Parkinson & Son, Shipley.—The well-known "Sunderland" system of gear-cutting is a generating one using a rack-shaped cutter, which passes across the face of the wheel in a planing action, producing teeth and spaces, and at the same time the blank or wheel being cut is rotated and the cutter advanced tangentially in unison, similarly to the rolling action of a rack and pinion. One cutter only is required for each pitch for any number of teeth required. The arrangement of the motor drive for a "Sunderland" gear planer is shown in fig. 21, from which it will be seen that an angle bracket is fixed to machined seatings on the main casting, on which the motor is mounted.

The Lea Recorder Co., Ltd., Manchester, has on show a small size combined indicating, recording, and integrating water meter, with a maximum capacity of 30,000 lb. per hour, of the type generally installed for the purpose of measuring boiler feed water as an aid to fuel economy. Another device that is shown working is the Lea coal meter, illustrated in fig. 23. The meter is fitted to

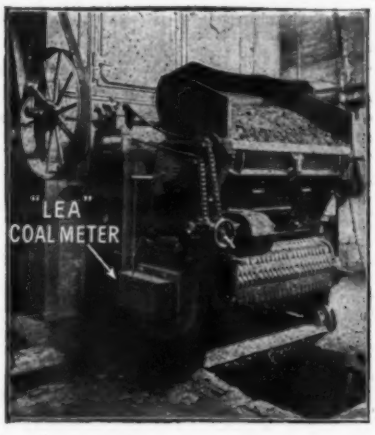

Fig. 23.—Lea Coal Meter.

a model stoker to show its method of working, and when used in conjunction with a feed water meter, two sets of figures are constantly available, from which the all-important data in every boiler house, lb. of water evaporated per lb. of fuel burnt, can be determined.

The apparatus is designed to work with chain-grate stokers, and operates very much on the same lines as the well-known V-notch water recorders. Its action is based upon the theory that when coal is supplied to a furnace by means of a chain-grate stoker, the amount of fuel passing under the fire door may be regarded as a stream with a constant width, but the depth and velocity of the

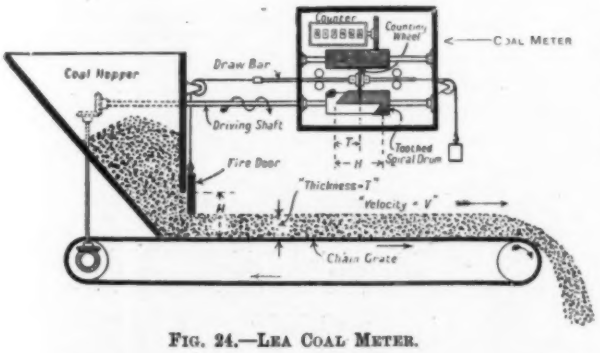

Fig. 24.—Lea Coal Meter.

stream are subject to variation. The width of the stream is the width of the chain grate, the depth is the thickness of the fire, and the speed is the rate of travel of the chain grate. Therefore, if W = width of stream in ft.; T = thickness or depth in ft.; and V = velocity of stream in ft. per hour; then 1 cb. ft. per hour = W × T × V = cross sectional area × V. It has been found by experience that under ordinary conditions of working the flow of coal under a fire door is, generally speaking, proportional to the thickness of the fire and to the velocity of the grate, and that the results are very consistent with what might be expected, theoretically. As W is constant, and T and V are the only variables, all that is required is some form of automatic integrating mechanism which will at all times take into account the two items T and V, and this is what the recorder does. As will be seen from fig. 24, the motion of the grate is transmitted by gearing to a spirally toothed drum, the pitch of the teeth of which is equal, or proportionate to, the maximum lift of the fire door, or the thickness of the fire H. A toothed counting wheel gearing with the spiral drum blow, and with a counting box above, is mounted on a rod directly connected with the fire-door; as the latter is opened or closed, the counting wheel is moved to and fro laterally across the spiral drum, which causes the wheel to revolve, more or less, according to its lateral position. Assuming an 8-in. fire to be the maximum, with that thickness of fuel the counting wheel will engage with all the teeth of the drum; with a 4-in. fire the counting wheel will only engage with half of them, and if the fire-door is shut the counting wheel and drum will not engage at all. Therefore, it is claimed that for all variations in the thickness of the fire, or in the speed of the grate, the number of revolutions of the wheel will be proportional to the total cubic feet of coal that is passed, and by means of proper constants for the units shown on the counting dials, the total quantity can be determined closely. The apparatus occupies little space, as shown by fig. 23, it need not be attached to the boiler itself, is easily read, requires no skilled attention, and the wearing parts are few. The makers give a guarantee of accuracy to within 5 per cent., and it is claimed that actual weighing is not more exact unless fine corrections are made according to the varying moisture content of the coal. One standard instrument serves for all boilers; the recording is in plain figures and is cumulative. The value of the unit is found by experiment, for example (the figures are fanciful), assume that a weighed or measured ton of coal is passed through in 97 revolutions of the counting wheel, then the total count for a day, week, &c., is divided by 97 to find the number of tons consumed by each boiler. The meter should prove extremely useful, in co-operation with other recording instruments, especially in checking the performances of individual boilers.

The Westminster Tool and Electric Co., London.—Although not a direct exhibitor, one of the firm's "super" electric drills is on view on the extremely interesting stand of the Skefko Ball Bearing Co., Ltd., as the firm's Mark I series of drills is fitted with these ball bearings throughout. The drills, which are in use in many British shipyards and general engineering works, are driven by powerful electric motors, and have proved very useful for such work as drilling, counter-sinking, reaming, &c., and on test,

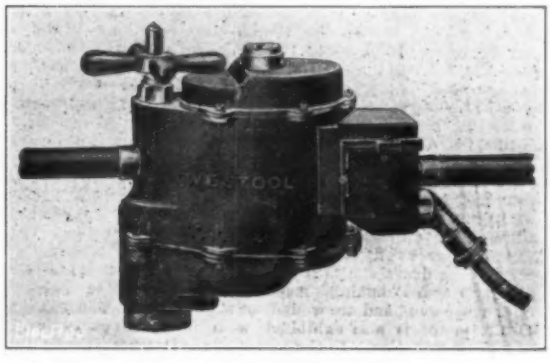

Fig. 25.—"Westool" Portable Electric Drill.

the following work has been easily performed with them. The No. 3A machine drills 2-in. holes in mild steel 1 7/16 in. deep in one minute, with an average current consumption of 3,000 watts. For the No. 2 drill the makers are using the same motor which they have fitted for the past five years to their old No. 3 pattern, so that the reserve of power is a practical safeguard against burn-outs. The No. 1 drill is undoubtedly an extremely handy little tool; it will drill 7/16-in. holes in steel 2 5/16 in. deep per minute, with a current consumption of only 875 watts, a creditable performance The particular type of D.C. drill illustrated in figs. 25 and 26.

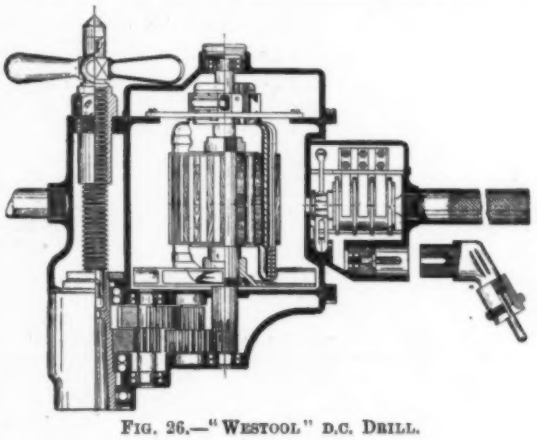

Fig. 26.—"Westool" D.C. Drill.

weighs only 60 lb., and all its parts are interchangeable; it is fitted with a No. 3 Morse taper, will drill 1¼-in. holes in steel, and expand tubes to 4 in. The gears are so arranged that by exchanging the two pinions, without alteration of wheel centres, two-speed ratios can be obtained—one the standard for ordinary drilling and reaming work at a speed of 160 R.P.M., and the other for tube expanding or tapping work at a speed of about 80 R.P.M.

The feed screw in the No. 3, Mark I, 1920-pattern machine illustrated is placed in a separate chamber parallel to the field poles and armature. This arrangement enables the overall length of the drill to be reduced to 13¾ in., and the effective length of feed increased to 6in.; it also permits an oval shape for the drill body, which renders it specially suited for corner drilling. The gear case, top bonnet, and drill body are made of special alloy steel, giving the necessary mechanical strength to the tool. The armature core is made of iron stampings with former-wound double silk-covered wire coils. A shrouded fan is fitted at the lower end of the windings, which produces a strong draught of air not only round the windings, but also through the ventilating holes provided in the core stampings and commutator. Carbon brushes are used, mounted in spring holders fitted to an insulating plate secured to the body, leaving the top bonnet free to be removed without disturbing the brushes or their connections. The coils are former-wound, well taped and impregnated with insulating varnish. The switch is of strong design and of the double-pole drum-contact type, with a quick make and break action and positive "on" and "off" positions complying with the Home Office requirements. The switch can be supplied suitable for running in either direction if desired. The drills are made in various sizes, and each is supplied with a Morse taper socket, safety cable connector, and a length of C.M.A. "cab-tire" cable containing an earth wire.

Messrs. H. Berry & Co., Ltd., Leeds.—Amongst the exhibits on this stand an electrically-driven furnace charger is on view, designed to push billets through a continuous furnace, and is shown complete with safety tappet arrangement. It is driven by a 5-B.H.P. motor, has a 4-ft. stroke, and is capable of developing power up to 4 tons and feeding at the rate of 10 ft. per minute. Another exhibit is an hydraulic pressure-pump of the portable electrically-driven type, the drive being through worm gearing. The set is completely fitted as a self-contained unit for such purposes as boiler testing, &c.

Messrs. E. Brook, Ltd., Huddersfield, have on view a range of A.C. motors wound for single, two and three-phase, and ranging in size from 1·5 to 100 H.P. The machines shown comprise the following:—A 15-H.P., 415-volt, 50-cycle, 950-R.P.M. weather and drip-proof motor and a 50-H.P. pipe-ventilated machine having a fan internally connected with the rotor, suitable for use in chemical and very dusty works. The totally-enclosed 1·5-H.P., 950-R.P.M. "Loom" motor shown, as its name indicates, is suitable for textile works, and is fitted with a belt cradle. A double helical reduction gear, ratio 6 : 1, is on view, fitted to a 5-H.P. motor, and also a spur gear placed on top of a 3-H.P. machine. The 10-H.P. vertical motor is suitable for driving hydro-extractors and the like, while the 60-H.P. low-speed one is of the ordinary protected type, but fitted with a third bearing, bedplate, and rope pulley. The firm's standard non-automatic starters are attached to the two small "buffing" machines shown, which have extended shafts at each end and are wound for single-phase. The stator of a 100-H.P. motor is also exhibited, with its windings exposed to allow of examination. In the centre of the stator is placed a ½-H.P. machine to show comparison.

(To be concluded.)

NEW PATENTS APPLIED FOR, 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

25,444. "Motor controllers." Cutler-Hammer Manufacturing Co. and Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). September 3rd.

25,445. "Rheostats." Cutler-Hammer Manufacturing Co. and Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). September 3rd.

25,446. "Magnetos." Soc. Anon. la Magneto Belge. September 3rd. (Belgium, September 3rd, 1919.)

25,447. "Ignition magnetos." Soc. Anon. la Magneto Belge. September 3rd. (Belgium, September 3rd, 1919.)

25,451. "System for controlling relays for wireless high-speed telegraphy, &c." Siemens & Halske Akt. Ges. September 3rd.

25,464. "Automatic electric sub-station systems." Metropolitan-Vickers Electrical Co. (Westinghouse Electric and Manufacturing Co.) and Westinghouse Electric and Manufacturing Co. September 3rd.

25,465. "Polarised relay for controlling rotary converters." Metropolitan-Vickers Electrical Co. (Westinghouse Electric and Manufacturing Co.) and Westinghouse Electric and Manufacturing Co. September 3rd.

25,466. "Time-limit relays for electrical supply systems." Metropolitan-Vickers Electrical Co. September 3rd. (U.S., September 3rd, 1919.)

25,487. "Number dials for automatic telephone systems." J. E. Collyer and E. A. Petithory and Siemens Bros. & Co. September 3rd.

25,491. "Electric batteries." H. Powell. September 4th.

25,504. "Telephone instruments." J. H. T. Roberts. September 4th.

25,534. "Rheostats for arc lamps of kinematograph machines." H. W. Baker. September 4th.

25,537. "Electric lamp fittings." A. S. E. Sedgwick. September 4th.

25,539. "Method of fixing insulating rings on shafts." Naamlooze Vennootschap Electrotechnische Industrie voorheen (W. Smit & Co.). September 4th.

25,545. "Electric regulating systems." British Thomson-Houston Co. (General Electric Co.) and General Electric Co. September 4th.

25,552. "Electric lighting of motor-cars, &c." T. W. Rickard. September 4th.

25,573. "Providing high-frequency alternating currents." A. M. aylor. September 6th.

25,599. "Trolley-heads of electric tramcars, &c." A. Harwood. September 6th.

25,623. "Insulators for supporting electricity conductor wires, telephone wires, &c." H. de S. Himmelstjerna and R. M. Scott (Himmelstjerna). September 6th.

25,624. "Electromagnetic wave-receiving systems." Radio Communication Co. and J. Scott-Taggart. September 6th.

25,627. "Device for indicating interruptions in electric circuit." W. E. Bottom and M. H. Goldfarb. September 6th.

25,650. "Electric transforming systems or devices." H. B. Brooks. September 6th.

25,669. "Sparking plugs." A. G. Brown. September 6th.

25,679. "Field magnets for magneto-electric machines, inductors, ignition apparatus, &c." Philipps Akt.-Ges. September 6th. (Germany, September 6th, 1919.)

25,708. "Dynamo-electric machines." Electro-Dynamic Construction Co. and N. Pensabene. September 7th.

25,719. "Ventilation of dynamo-electric machines." A. B. Field and Metropolitan-Vickers Electrical Co. September 7th.

25,737. "Means for magnifying changes in electric currents." A. Orling. September 7th.

25,746. "Sparking plugs." C. Andreason. September 7th.

25,792. "Starting polyphase asynchronous electric motors." Akt.-Ges. Brown, Boveri, et Cie. September 7th. (Switzerland, September 8th, 1919.)

25,825. "Electric accumulators." W. H. B. Stevens. September 8th.

25,833. "Electric cooking appliances." A. C. Hammonds and M. J. Wagg. September 8th.

25,861. "Starting and lighting systems for motor vehicles." H. M. Ainsworth and Soc. Anon. des Anciens Etablissements Hotchkiss et Cie. September 8th.

25,872. "Battery-charging switch." J. Atkins. September 8th.

25,875. "Commutators of Ford engines." L. F. Lambert. September 8th.

25,887. "Electric gramophones." M. Mosely. September 8th.

25,889. "Electrical cutting machines." R. S. MacGregor and J. Wass. September 8th.

25,916. "Sparking plugs." F. W. Schroder. September 8th.

25,956. "Telephone call meter carrier." H. B. Merton. September 9th.

25,959. "Sparking plugs." S. Remus. September 9th.

25,962. "Electric lamps for motor cars, &c." H. Rottenburg. September 9th.

25,965. "Operating electrodes of electric furnaces." J. A. Davey and Electro-Metals, Ltd. September 9th.

25,967. "Method of operating luminous electric discharge lamps, &c." E. Schaeffer. September 9th. (Germany, September 9th, 1919.)

25,977. "Electrolytic rectifier cell." J. Kremenezky (firm of). September 9th. (Austria, March 14th, 1918.)

25,988. "Magnetic separators." C. Clarke. September 9th.

26,007. "Method for generating electricity." E. E. Dutt. September 9th.

26,008. "Method for conversion of latent heat into electricity by thermo-electrical apparatus." E. E. Dutt. September 9th.

26,035. "Electric switches, &c." Electric Control, Ltd., and J. J. Fisher. September 10th.

26,036. "Electromagnetic apparatus." R. E. H. Carpenter and F. G. Creed and Creed & Co. September 10th.

26,043. "Mounting clips for electrical switchgear." W. J. Line and J. H. Tucker & Co. September 10th.

26,044. "Contacts for electrical switches." W. J. Line and J. H. Tucker and Co. September 10th.

26,057. "Method for conversion of latent heat into electricity." E. E. Dutt. September 10th.

26,060. "High-tension transformers." A. C. Gunstone. September 10th.

26,094. "Effecting ignition and accelerating combustion in thermo-dynamical prime movers." S. Ruzicka. September 10th.

26,104. "Electrolytic cells for production of chlorate of alkali metals." J. T. Barker and United Alkali Co. (Barker). September 10th.

26,113. "Electric ignition." F. H. Richards. September 10th.

26,117. "Electric power transmission." A. M. Taylor. September 11th.

26,148. "Control systems for electric motors." S. Gowan and Metropolitan-Vickers Electrical Co. and L. Miller. September 11th.

26,154. "Magneto-electric machines." British Thomson-Houston Co. and A. P. Young. September 11th.

26,156. "Apparatus for starting synchronised asynchronous motors." Compagnie Général Electrique. September 11th. (France, September 20th, 1919.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1914.

6,439. "Filaments for incandescent electric lamps and methods of making the same." British Thomson-Houston Co. (General Electric Co.). March 13th, 1914.

1918.

561. "Electric switches." A. H. F. Perl." October 24th, 1918. (Cognate application, 17,404/18.) (149,701.)

10,290. "Ionic relays." W. H. Eccles and F. W. Jordan. June 21st, 1918. (149,702.)

20,746. "Electrical furnaces." F.I.A.T. Fabrica Italiana Automobile Torino. December 12th, 1917. (121,485.)

1919.

5,894. "Electrical furnaces." F.I.A.T. Fabrica Italiana Automobile Torino. November 2nd, 1918. (Addition to 121,485.) (134,810.)

6,457. "High-tension insulators." R. M. Johnston. March 14th, 1919. (149,713.)

11,882. "Fluid pressure brake apparatus." British Thomson-Houston Co. (General Electric Co.). May 12th, 1919. (149,729.)

12,153. "Means for covering or coating electric conductors, wire, and the like with liquid or plastic materials. F. C. Cook. May 14th, 1919. (149,736.)

12,233. "Tool for electric cable stripping." G. H. Scholes and E. A. Claremont. May 15th, 1919. (149,739.)

13,620. "Coil-winding mechanism." Igranic Electric Co. and S. Wright. May 29th, 1919. (149,799.)

13,773. "Telephone systems." Relay Automatic Telephone Co., G. H. Bryant, B. B. Johnson, and F. M. Ward. May 30th, 1919. (149,800.)

13,795. "Insulators for overhead transmission lines such as telegraph and telephone line wires." E. A. Chantler. May 31st, 1919. (149,801.)

1920.

665. "Engine starters." Eclipse Machine Co. August 2nd, 1919. (149,308.)

7,417. "Electric muffle furnaces." October 18th, 1919. (Divided application on 146,673.) J. R. C. August. (149,893.)

7,945. "Electric motor control." J. F. Tritle. June 6th, 1919. (144,612.)

13,171. "Electrically-operated time-controlled switches." L. J. Larsen. May 12th, 1920. (149,903.)